THE TEXTILE MANUFACTURER

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Notes of the Month

TEXTILE INDUSTRY U.S. STUDY TOUR

THE American Textile Machinery Exhibition-International, to be held in Atlantic City, New Jersey, May 23 - 27, will undoubtedly be one of the most outstanding textile events in 1960. Sponsored by the American Textile Machinery Association, the exhibition has already aroused tremendous interest throughout world textile circles. Reported to be the largest display of capital equipment ever held anywhere for textile processing, manufacture and finishing, it will be visited by technical and economic executives from companies in many countries. They will be keen to observe and get first-hand information on American mill and factory methods and discuss on the spot some of the very latest developments in machinery and processes—including British and Continental—a substantial proportion of which will be on view for the first time. Textile manufacturing techniques in America differ considerably, of course, from those largely employed in this country and many others. Designed for continuous operation in many phases—and mass production—the objective has been consistently high quality products at low unit cost. Within this broad plan the textile machinery makers in general have done their utmost to provide plant and machinery offering manufacturers the twin advantages of high productive efficiency at the same time raising the standards of working conditions for the operatives. In the U.S., fundamental differences also exist in promotional and marketing knowledge and activities.

Re-equipment and shift-working are two vitally important problems—amongst others—facing Lancashire at the moment and, although this exhibition is of considerable interest to all sections of the textile industry, it is certainly one which progressive Lancashire spinners and manufacturers can ill-afford to ignore. In these momentous days, time is probably the most valuable commodity in modern business. It is, therefore, particularly interesting to note that full realisation of all the factors involved has resulted in an excellent travel programme devised by Touramerica and Thomas Meadows and Co. Ltd., in co-operation with Pan-American World Airways.

Organised as a study tour this highly efficient arrangement offers textile executives in this country the opportunity of seeing the latest machinery in operation in Atlantic City Auditorium and, during the same trip, to obtain up-to-the-minute knowledge on specific phases of the American textile industry; the tour is so balanced as to give members taking advantage of it an inside view at some of the key points.

Every detail seems to have been covered in this comprehensive scheme. The study tour is in two parts (A and B), part B being optional. Members will leave London for New York on May 17 by Pan-American Jet Clipper. On the following morning they will meet the editorial staff of one of America's foremost textile journals for mutual discussion on topics of textile significance. In the afternoon the New York offices of Burlington Mills will be visited to hear a vice-president of the company talk on textile marketing and merchanting methods in America. The next day (May 19) an official of the New York Cotton Exchange will tell the visitors about its activities after which they will be taken through the Exchange. Immediately afterwards, the headquarters of the National Cash Register Co. will be visited for a survey of recent advances in such fields as stock control, cost accounting, wages calculations, accounts receivable, etc. Officials of this company will then conduct the visitors to Bergen Mall Shopping Centre, New Jersey, where, surrounded by huge parking fields every type of shop is represented—including supermarkets which are rapidly becoming outlets for textile goods.

During the morning of May 20, the visitors will attend a special forum, the panel of which will consist of a buying office representative, a store fashion co-ordinator, the editor of a fashion fabrics magazine, a yarn company official, designers and piece-goods buyers in various categories. The discussion will cover (*a*) how and when fabrics are bought and promoted, (*b*) what manufacturers and designers look for in the European fabric market and (*c*) the co-ordination and pre-market planning between mills and factories, garment, etc., manufacturers, retailers and fashion publications. In the afternoon the party will visit one of America's best-known advertising agencies, handling the advertising accounts for several large textile concerns, and specialists will speak on American marketing and advertising methods in relation to the textile industry. This week-end will be left free for activities, rest or individual activities such as sightseeing, etc. Monday (May 23) will begin with a visit to the new headquarters of Deering Milliken and Co., where top executives will explain some of the marketing and sales methods adopted in this very large textile concern. A visit in the afternoon to Commercial Factors—one of the leading firms financing "accounts receivable" for the textile industry and widely used in America—concludes this day.

The next three days (Tuesday, Wednesday, Thursday) have been specially set aside to give the members of the study tour ample time to see the textile machinery exhibition at Atlantic City. Over 500 exhibitors from the U.S. and twelve other countries will display the latest developments in the textile field. The equipment, much of it on view for the first time, will include modern machinery for opening, cleaning, blending, drawing, and spinning practically every type of raw material such as cotton, wool, silk, bast fibres, and the ever-increasing range of man-made fibres. Processes will include the newest developments in yarn

preparation methods such as the latest in high-speed automatic and semi-automatic cone, cheese and pirn, etc., winders, high-speed warping and beaming equipment, gassing and doubling machinery, developments in creels, etc. Weaving machinery will include looms for weaving almost every class of fabric from ribbons to heavy industrial cloths. Many beautifully built pirn and shuttle changing automatic looms will be weaving a wide range of dress, suiting, etc., cloths and furnishing fabrics. Single shuttle and multi-box looms will be appropriately fitted with the latest in tappet motions, dobbies and jacquards. Ancillary equipment on view will include an infinite range of healds and reeds, shuttles, loom leathers, spindles, bobbins of every kind and construction, boxes, mill transport trucks, conveyor and handling systems, motors, pumps and valves, mixers, etc. Other equipment will comprise tufting and coating machinery, air cleaning systems, a wide range of testing equipment and instruments, recorders, etc., and every kind of mill accessory. Dyeing, printing and finishing sections will also be represented in all phases.

On Friday, May 27, members will be taken to Washington and on Saturday will attend a reception arranged by the National Cotton Council of America. Here executives will talk on the promotion of cotton goods and what is done about it in the U.S. and abroad, also the market research undertaken to determine the trends for cotton use and its most favourable potentials. Sunday is a free day and on Monday the Textile School of the North Carolina State College will be visited to see some of the research investigations being undertaken. Other interesting visits will be made before the members of the study tour depart on Tuesday morning by Pan-American Jet Clipper for London Airport.

Part B (optional) in this travel programme also includes visits to several of the best textile concerns in the U.S. Every detail in this study tour has been very carefully thought out and full advantage should be taken of this unique time-saving opportunity. Full information will be gladly supplied on application to Thomas Meadows and Co. Ltd., 66a London Road, Leicester, Pan-American World Airways System, Lombard House, Gt. Charles Street, Birmingham 3, or any of the branch offices throughout the country.

RE-EQUIPMENT GRANTS FOR THE COTTON INDUSTRY

THE Board of Trade announced last year that, in view of the response to the schemes for scrapping machinery in the spinning, doubling and weaving sections of the cotton industry, they intended to bring into effect for those sections the re-equipment grants for which provision was made in the Cotton Industry Act, 1959. Now that the terminal date, March 31, of the period for scrapping machinery under the redundancy schemes is approaching, the Cotton Board are issuing, on behalf of the Board of Trade, details of the general conditions on which re-equipment grants will be made available. The grants will be made by the Board of Trade and will be payable towards the cost of purchasing and installing new machinery or equipment for the purpose of re-equipping or modernising spinning, doubling or weaving mills.

The normal rate of grant will be 25% of the net eligible expenditure incurred for these purposes after April 23, 1959, the date when the Government announced their proposals for the reorganisation of the cotton industry. Orders must be placed not later than July 8, 1962, and the re-equipment or modernisation completed by July 8, 1964. Firms may obtain copies of the general conditions and of application forms from the Cotton Board or from trade associations.

EFFECTS OF REDUNDANCY

HOWEVER important other matters may be the Government's scheme of reorganisation of the industry means the dismissal of thousands of men from their life time employment and therefore a matter of vital concern to those affected. In other sections of the industry, says Mr. C. Schofield, general secretary of the Operative Spinners' Amalgamation, in the quarterly report of the Executive Council, the dismissed workpeople have in general the opportunity of re-engagement at their own trade at some other mill but no such re-absorption is possible for mule spinners except in a very few instances where night shifts have been introduced and up to the present has only affected fewer than one hundred men. Members have therefore had to take employment outside and within the industry at wages ranging from two to five pounds per week less than they earned at their usual occupation, in many cases resulting in an enforced lowering of their standards of living and a revision in outlook as far as their families are concerned. A considerable handicap is also placed upon the men of 50 years of age and over whose ability to perform other work is restricted and it is on members of this age group that the hardship due to the slowness in paying the redundancy allowance is falling heavily.

The reorganisation scheme is regarded in official and employer quarters as being one to make the industry more compact and efficient, continues Mr. Schofield, but judged by the profits now being made and the increase in share prices, it certainly looks like having a "third dimension" of considerable size. "All the available evidence shows too that the people who are going out will not have much to complain about. If a leading newspaper's report of the Lands Tribunal hearing is correct, the Fir Mill Ltd., Royton, will receive £87,000 from the Government which, presumably, will be supplemented by the amount arising from the trade levy as required by the Act. This mill is fairly representative of the trade and will, therefore, reflect generally the position of all who have chosen to scrap their plant. In addition, the company will have the mill fabric and other assets for disposal. "It is interesting to note," adds Mr. Schofield, "that whilst the largest amount payable to a workman who is dispossessed of his livelihood is 30 weeks' wages, the sum of £22,500 is the value being placed upon the loss sustained by three directors of a firm in the process of being wound up. In making these comparisons only one conclusion can be arrived at as to who is really being called upon to make a sacrifice and that is the workman who, by a decision of a remote board of directors, is discharged from the job he has been engaged upon all his working life."

"TEXTILE MANUFACTURER" INDEX

The full index—by subject and author—covering the entire contents of the *Textile Manufacturer*, January to December, 1959, is now available and will be forwarded, post free, to subscribers on application to the Publishing Department, *Textile Manufacturer*, 31 King Street West, Manchester 3.

Textile Mill Maintenance—4

The only way to maintain an air compressor set working at maximum efficiency is to check constantly for faults. Log sheets are invaluable and all instrumentation should receive systematic attention. When faults are detected remedial action should be prompt

By F. H. SLADE, A.M.I.MECH.E.

THREE features must be observed in properly maintaining an air compressor plant, and these are (*a*) cleanliness, (*b*) lubrication and (*c*) routine servicing. Cleaning not only leads to better housekeeping, but also ensures constant inspection of the plant as a whole. Insufficient lubrication, loose bolts, nuts or keys, etc., are thus nearly always discovered in time to prevent trouble. Lubrication of both compressor and motor should always be carried out strictly in accordance with the maker's instructions.

Here the objectives are reduction of friction, reduction of wear in all working parts to the lowest possible figure, and maximum reduction of carbon deposits. The presence of carbon deposits seriously detracts from the efficient operation of the compressor valves. Such deposits tend to lodge under the discharge valve and allow air, already hot, to leak back into the compressor cylinder. This promotes higher compression temperatures and, by cumulative effect, causes more carbon deposit and a correspondingly increased leakage. A sharp rise in the discharge temperature will indicate leakage due to either carbon deposit or a broken valve.

Lubrication may, of course, be considered as being embraced in plant servicing. The latter, however, covers a wide range of duties; which should be carried out at regular periods. A tabulated instruction sheet, of the type shown in Table 1, assists in this direction. Security of compressor and motor fixings is, for example, most essential and thus, good practice indicates that these should be checked for tightness once a week.

All adjustment should, of course, be carried out in accordance with the maker's instructions, but additionally all parts likely to work loose should be subject to rigid monthly or bi-monthly inspection. Generally, such faults, when occurring in working members, are indicated by noise.

Table 1. Typical Schedule of Routine Servicing

Set Period	Service Duty
Daily ..	(1) Check oil level in crankcase and lubricator; replenish if necessary.
	(2) Check oil pressure and air temperatures.
	(3) Drain air receiver after each run, or at least daily, to prevent accumulation of oil and moisture.
	(4) Drain intercooler, and if fitted, aftercooler, after each run, or at least daily.
	(5) Check safety valves on compressor and air receiver.
Weekly ..	(1) Check compressor and motor fittings.
	(2) Check all joints, unions, etc., on compressor and between compressor and air receiver.
	(3) Check driving belt tension (if belt driven) and adjust if slack.
Bi-weekly ..	(1) Clean air-inlet filter.
Monthly ..	(1) Inspect and clean safety valve on air receiver.
	(2) Inspect and clean inlet and delivery valves.
	(3) Clean out crankcase and replenish with new oil; prolonged use of dirty lubricating oil causes corrosion and wear of bearings and cylinder bores. If compressor is run intermittently, change oil after 200 - 250 hours' running.
	(4) Check all nuts and bolts, cotterpins, gear wheel, fly wheel fixings, etc.
Half-yearly ..	(1) Inspect and clean receiver; treat all cleaned surfaces with anti-corrosion paint.

However, to wait until the machine becomes noisy before taking corrective action is alien to the whole spirit of preventive maintenance. Typical fasteners calling for regular inspection are all nuts and bolts, cotter-pins, gearwheels and the flywheel fixings.

A weekly check should be made to prevent air leakage at all joints, unions, etc., on the compressor, also between compressor and air receiver. The receiver inlet valve requires inspection at the same time and the safety valve on the receiver should be subjected to attention, preferably once a month. Both cleaning and lubrication are necessary. Should the valve be provided with distance pieces under the adjusting screw, dismantling may be effected without any special precautions; if a lock nut is used, a dimensioned sketch should, however, be made before dismantling. The object of the cleaning is not so much to ensure that the valve will work freely, although this is very important, as to remove any foreign matter which always seems to accumulate under the valve. If the valve blows, little pieces of hard carbon, etc., may be jammed between the valve and seat when it re-seats, and the valve will therefore leak. The receiver itself should also be cleaned and inspected every six months, and the cleaned surfaces treated with a high-quality anti-corrosion paint.

The only way to keep an air compressor set working at peak efficiency is to check constantly for faults. When faults are detected remedial action should be prompt. Faulty operation, often leading to major breakdown, can usually be ascertained at an early stage from properly maintained log sheets. This, however, is only possible if the instruments fitted to the machine are working correctly. Clearly, all instrumentation should receive systematic attention.

Valve Maintenance

In Tables 2 and 3 are given a few of the faults that can arise in compressor and motor operation, symptoms of these faults and remedial action that may be taken. In the case of a reciprocating compressor, the importance of regular valve inspection cannot be over emphasised. Every event taking place in the machine is directly related to the operation of the valve; thus on their proper working depends the whole well-being of the compressor. With all the knowledge, experience and skill put into the design and manufacture of the valve, a fault in the metal of valve plate or spring may cause failure; unless this is detected in the early stages it may cause a lot of trouble. The frequency of the examination will depend on the number of hours run by the com-

Table 2. Fault-Finding Chart for Air Compressors

Symptom	Probable Fault	Action
No oil pressure indicated on starting compressor	(1) Insufficient oil in crankcase	(1) Fill to correct level
	(2) Defective or broken oil gauge	(2) Repair or replace
	(3) Obstruction in oil pipe	(3) Remove oil pipe and clear
	(4) Broken oil pipe	(4) Repair or replace
	(5) Broken pump shaft	(5) Replace
Low oil pressure	(1) Low oil level	(1) Replenish oil
	(2) Oil too light in body	(2) Drain and fill with oil recommended by makers
	(3) Leaking or broken oil pipe	(3) Tighten or replace
	(4) Defective gauge	(4) Repair or replace
	(5) Dirty strainer or obstruction in oil pipe	(5) Clean strainer and lubrication system and replenish with clean oil
	(6) Worn pump gear	(6) Replace
	(7) Loose bearings due to wear of improper adjustment	(7) Adjust correctly or replace
Excess carbon on valves	(1) Oil too high in crankcase	(1) Reduce to proper level
	(2) Too long operation without cleaning	(2) Establish definite period between cleaning
	(3) Poor quality oil	(3) Change to recommended grade
	(4) Too high oil pressure	(4) Reduce to design pressure
	(5) Piston rings stuck in grooves, or worn	(5) Clean or replace
Unloader flutter	(1) Dirty strainer in unloader piping between unloader and receiver	(1) Remove and clean
	(2) Leaking or broken pipe between unloader and receiver	(2) Tighten or replace
	(3) Too close an operating range	(3) Adjust to widen range
Unloader not operating	(1) Valve sticking	(1) Take unloader apart and clean
	(2) Valve lifter piston sticking	(2) Strip unloader inlet valve cover assembly and clean
	(3) Leakage at diaphragm	(3) Tighten set screws at valve cage, or, if diaphragm is damaged, replace
Intercooler safety valve blowing	(1) High-pressure oil and discharge valves leaking	(1) Re-condition valves
	(2) Reduced cooling effect	(2) (a) If water-cooled check system for flow and/or dirty tubes (b) If air-cooled, clean fan and external surfaces of intercooler; tighten fan belt
	(3) If blowing while machine is unloaded, the high pressure unloading diaphragm is leaking, or the high-pressure discharge valve is leaking	(3) Tighten or replace diaphragm; re-condition or replace valve
	(4) Safety valve fault	(4) Re-condition and reset, or reset to blow at predetermined design pressure
High intercooler pressure	(1) Faults and action the same as for safety valve blowing	—
Low intercooler pressure	(1) Low-pressure inlet or low-pressure discharge valve leaking	(1) Recondition or replace valve
	(2) Leaking intercooler	(2) Repair
	(3) Leaking joint or pipe between cylinders and intercooler	(3) Tighten or repair
	(4) Worn low-pressure cylinders or piston rings	(4) Rectify either or both parts

pressor; for a machine running on double shift, the valves should be examined once a month and *pro rata*.

Generally speaking, the higher the rotational speed of the compressor the more likely is it that any initial fault in the metal will result in failure; thus, the more frequent should be the examination. Each time the valves are removed for examination, the spare set should be exchanged with the used ones, which can, by this means, be carefully and methodically examined on the bench. There is another side to this changing of the valves. The valve is probably the most highly stressed part of the compressor; the chief component of this stress is fatigue and there is reason to think that resting the valves tends to relieve fatigue stress.

After the valve assembly has been removed, it should be stripped down and all components carefully inspected, especially the valve discs and seatings, for wear, damage or pitting. A bright, plain, circular impression on both disc and seating face indicates a properly seating valve. The disc should also be flat and free from distortion. The first step in maintenance is to lap and polish the faces, taking care to remove no more material than necessary. Valve springs should be tested for free length against a standard unused spring, to indicate any weakness or fatigue. The removal of all carbon deposits and dirt from the complete assembly is of the greatest importance.

Typical faults that can arise from dirty and badly maintained valves are shown, with some exaggeration, in Fig. 22 (Halliday, Compressed Air Engineering, Vol. 18, No. 204). The absence of a sealing ring under the delivery valve cap flange, a not uncommon oversight, not only results in compressed air losses, but tends to reduce the allowable space for valve disc movement. A soft metallic sealing ring is essential at this point, unless the contacting surfaces are very accurate and carefully bedded together to give a gap no greater than 0·001 in. at any point. The use of sealing compounds as an alternative is deprecated. Thus, to overcome the difficulties that might arise in the event of a sealing ring being mislaid during inspection or cleaning operations, it is advised that a supply of these components are always kept in stock.

Protrusion of the cap shank too deeply into the valve chamber results in restricted valve movement and the possibility of reduced discharge. A complementary trouble can arise here from overheating, due to after-compression of a portion of the air charge failing to be evacuated from the cylinder. It therefore follows that care should be exercised in the replacement of sealing rings, should it be necessary to remove stock to true the cap flange, an equal amount should be removed from the lower end of the shank.

A distorted valve disc can give rise to suction and delivery troubles, such as air being drawn back through the delivery valve into the cylinder during the suction stroke. This will have a similar effect to that given by the restricted movement of the valve disc. A common cause of valve distortion is the accumulation of carbon scale and dirt in the base of the recess on the undercut portion around the seating face. Unsuitable lubricants, and a dirty or inefficient air intake filter, are usually responsible. Such deposits on the suction side not only tend to promote valve distortion, but lead to troubles such as increased piston-ring wear, stiffened working and overheating. All deposits should be carefully removed from the valve mechan-

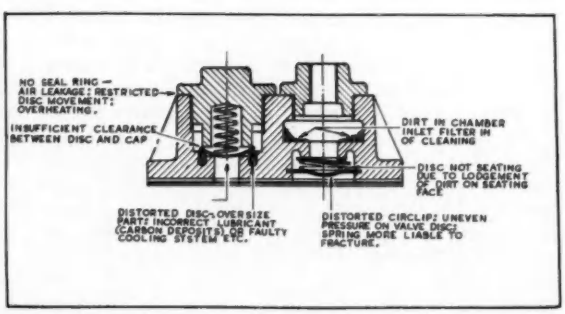

NO SEAL RING — AIR LEAKAGE: RESTRICTED DISC MOVEMENT: OVERHEATING.
INSUFFICIENT CLEARANCE BETWEEN DISC AND CAP.
DIRT IN CHAMBER INLET FILTER IN OF CLEANING
DISC NOT SEATING DUE TO LODGEMENT OF DIRT ON SEATING FACE
DISTORTED DISC: OVERSIZE PART: INCORRECT LUBRICANT (CARBON DEPOSITS) OR FAULTY COOLING SYSTEM ETC.
DISTORTED CIRCLIP: UNEVEN PRESSURE ON VALVE DISC: SPRING MORE LIABLE TO FRACTURE.

Fig. 22. Efficient operation of a compressor is largely dependent upon the proper functions of the suction and delivery valves. This diagram shows some of the defects responsible for unsatisfactory working

Table 3. Operating Faults Affecting Compressor Motor

Sympton	Probable Fault	Action
Motor fails to start	(1) Faulty wiring and incorrect voltage supply	(1) Ensure that (a) the motor is wired to the right type and voltage supply; (b) the wiring from the starter to the motor is properly connected, and (c) current is correctly wired to the starter itself
	(2) Fuses	(2) Ensure that fuses are in perfect order and are not "blown-out"
	(3) Switches	(3) Where automatic starting and stop control is fitted, check the wiring to the pressure switch, solenoid or electric mechanism employed to make sure that all contacts are properly made
	(4) Load	(4) Place no load upon the motor until it attains operating speed
Motor takes compression load before reaching full speed	(1) Loose joints in piping between adjustable check valve and unloading inlet valve covers	(1) Tighten or re-make joints
	(2) Diaphragm in one or more of the unloading inlet valve covers leaks	(2) Fit new diaphragm
	(3) Air vented too fast through check by-pass valve used in dual control	(3) Close by-pass until compressor takes the load just as the motor attains full speed
	(4) Seat in adjustable check valve leaks or has dirt under it	(4) Clean or replace valve
Motor losing speed and heating under load	(1) Load	(1) Ensure that unit is operating at proper speed and pressure and that no overload is placed on motor. Check high and low-pressure discharge valves, which if leaking will increase the normal load required by the compressor
	(2) Scored compressor cylinder	(2) Inspect cylinder walls from below, through inspection door and from above, after removing valves
	(3) Motor in poor condition	(3) Recondition motor throughout; checking bearings, etc.

ism, and attention given to rectification of the causes.

Another common cause of distortion of the valve disc is the accidental fitting of an oversized component, i.e. the outside edge of the disc may bear on the mouth of the recess instead of fitting easily. It is stressed that a new disc should fit freely within the recess and that a valve should never be reassembled for use if not fitting correctly. It is also stressed that the continued employment of a bent or damaged disc is in itself a cause of uneven wear on the seating face; thus, an undesired condition will become increasingly aggravated. A damaged or distorted spring clip retainer underneath the valve spring can also be responsible for improper operation. If badly distorted, it can impart an uneven pressure to the valve disc. Alternatively, it can render the valve spring more liable to fracture through over-compression on one side.

Two methods of valve cleaning may be cited. One consists in thoroughly soaking the valve in petrol or paraffin, followed by a brushing with a wire brush, or a light scraping to remove any carbon formation. Before replacement of a valve so cleaned, it is however, most essential that it is thoroughly dried, otherwise there is a likelihood of the liquid passing into the receiver in the form of a vapour and causing an explosion. With the second method the valves are cleaned after dismantling with a soft brush, using a hot soapy water and soda solution; for single stage compressors every 300 working hours, and multi-stage compressors every 500 working hours. If there is much dust in the air, the valves will require more frequent cleaning than if the intake air is clean and free from dirt. It is thus essential that care should never be relaxed in keeping the air intake filter clean and free from clogging.

General Maintenance

Where loss of efficiency cannot be attributed to any of the causes already mentioned, it may be due to leakage past the piston rings. These should then be checked for wear, which might interfere with good contact with the cylinder walls. The recommended gap when these rings are fitted in the cylinder is 0·004 to 0·006 in. New rings should be fitted if the upper limit is exceeded. Overheating may also be due, in the case of water-cooled units, to scaling-up of the water spaces. These should be inspected and, if necessary, cleaned, whilst the cylinder head is off. Inter- and after-coolers should receive similar attention, to ensure maximum heat-transfer rates.

It is essential that considerable care be exercised to avoid troubles in the water-cooling system for, unless rectified, these may lead to the distortion of working mechanisms, or even to seizure. Thus, the circulating water pump requires periodic inspection and attention for the avoidance of such possible faults as the choking-up of the strainer meshes on the water intake pipe, air-leaks at gland joints, air-locks in the water-feed pipes, badly fitted joints, etc. Overnight drainage of the water-cooling system during very cold weather is also advised, unless the plant is in use continuously.

On most after-coolers and inter-coolers fitted on compressors, the water goes through the tubes and the air round the outside of the tubes, and there is very little maintenance required on the air side of the cooler. At regular intervals the inside of the tubes should be cleaned either by brush or by an acid solution. The usual type of acid used is hydrochloric and it should be mixed in the ratio of 1 part hydrochloric acid : 3 parts water. The solution should be left overnight and should be thoroughly flushed out with clean water after this treatment.

More and more use is being made of inhibitors nowadays, as with this method there is no need to dismantle the cooler. These chemical descalers should be pumped through the system adding further quantities of the inhibitor until all frothing ceases. Again the system should be flushed out with fresh water. The strength of the solution varies so vastly that it is always advisable to get the manufacturer's advice on the matter, and several firms are experts in this subject. To remove oil films from the outside of the tubes a solution of washing soda and boiling water can be used, although there are many proprietary degreasing agents on the market today.

The first indication of leaky cooler tubes is an undue amount of air bubbles present in the water flow indicator, and a check can be made by shutting the machine down, blowing off the air pressure and opening the moisture drain on the air side. It is always difficult to ascertain which tube is actually leaking, but one method is to fill the air space with water and apply pressure by means of a pump, and by removing the water header the tube which shows water is the damaged one.

Compressed Air Mains

Next to the compression plant, the layout of the mains must receive careful consideration. It is no use having an efficient plant, if the mains are inadequate or badly installed. Choice of piping will generally lie

between mild steel and copper. Standard sizes of tubing in either material (up to 4 ins. dia.) have an ample safety factor and the light gauges, such as B.S. 1938 copper tubes are quite satisfactory. Steel has the advantage of being cheaper per foot run but it is more difficult to lay than copper, and more fittings are required because of the shorter lengths and the need to fit elbows at each change in direction. Copper can be obtained in 60 ft. lengths in the smaller sizes and be bent readily to follow the contours of buildings and machines. Often it will be found most economical to use steel for the main pipe and copper for the branches.

The transmission lines should be designed to keep the velocity of the air in the pipes to below 40 ft./sec. As the frictional losses between the air and the pipe vary directly with the length of duct—directly as the square of velocity and inversely as the diameter—a pipeline must be designed within reasonable limits. It is advisable also to reduce as far as possible the number of bends or changes in direction of the pipeline. Where this is unavoidable, bends with long sweeps should be used. A further rule to follow is that the pressure drop through a main should not exceed 5 to 10 lbs. at places farthest from the compressed-air plant. Branches from the air mains can be taken off at suitable places, the size of the branch being dependent on the volume of air they are intended to carry.

Throughout the layout and erection of the compressed air mains from the receiver it is suggested that a slope of 1 in 80 with the air flow should be maintained and a slope of 1 in 40 against the air flow. At the lowest point of each slope, suitable traps should be incorporated and adequate drainage arrangement made in the floor to draw-off collected oil and water. Taking branch lines from the top of overhead mains considerably reduces the possibility of feeding moisture to the air-using plant.

In many cases it is advisable that the air should pass from the receiver in the shortest practicable distance to a manifold from which are taken a number of mains of relatively small bore, rather than to rely on a single larger main of considerable length and progressively decreasing diameter from which branches are taken off to individual point of use as required. A convenient air-supply scheme that can be adopted for individual workrooms

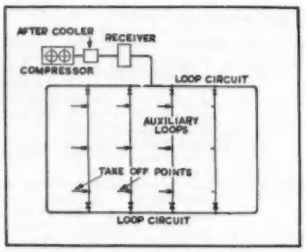


Fig. 23. For general applications the loop system illustrated offers many advantages, which include a virtually uniform pressure irrespective of local variations in consumption

is shown in Fig. 23. In this, two mains are extended from the manifold to form a single loop circuit around the workroom, with such auxiliary loops as may be required by the disposition of air consuming machinery. This layout ensures the maintenance of a virtually uniform pressure in the mains, irrespective of local variations in consumption. Stop valves can be placed in the loop system in such a way that they divide the workroom into relatively small sections, any of which may, for the purpose of repairs, modifications or the addition of a new take-off point, be isolated without detriment to the operation of the remainder of the system.

The use of flexible hose is common practice in machine furnishing, arranged in such a manner that it will not become damaged or inefficient. Otherwise, it becomes a maintenance hazard. Seamless flexible metal tubing also has a ready application, to act as a flexible coupling between the fixed end of a tube and a moving machine part. Here again maintenance is governed by installation, the right method leading to long and satisfactory service. Firstly, it should be understood that the type of tubing used and the method of fixing the end connections depend on pressure and the nature of mechanical movement to which the hose is subjected. Secondly, it is recommended that torsional stresses or frequent bending in alternating directions be avoided.

Incorrect end connections can be responsible for air leakage, especially when solderless fittings are used. To avoid this, it is imperative that the sealing ring presses full against the float ends of the flexible tubing to make an airtight joint. The use of connecting tubes that are too short can cause bending in alternating direction and consequent failure. Examples of this are encountered when catering for angular and parallel movement. The problem can be overcome in these cases in the manner indicated in Fig. 24. As shown at (A) provision is made for angular movement, with the minimum of bending in the flexible tube, fixed rigid tube bends and large radius bends in the flexible hose are also employed to accommodate parallel movement. It will readily be seen from these diagrams that the use of straight connections and short lengths of tubing can rapidly result in overstrain, and consequent failure, of the tubing.

It will be appreciated that dust and moisture are enemies of the plant engineer, and, in many cases, the process engineer. Of the two, moisture can cause the most damage and stringent precautions should be adopted to secure its elimination. In addition to those already discussed, much can be said for the incorporation of pipeline filters in the layout. These trap and retain the impurities in such a manner that they are easily removed The filters must, however, function with a high degree of efficiency, continuously and without excessive maintenance costs. Furthermore, they must on no account offer undue resistance or restrict the flow of air.

An ideal layout would include a large pipeline filter on the outlet side of the receiver, close to where the pipelines branch off in different directions. If the run of mains is considerable, i.e. in the order of 100 ft. or more, then another filter is needed at the point where the branches are situated. Finally, where a high degree of freedom from moisture is essential, a small vertical or horizontal filter should be located as near as possible to the point of usage.

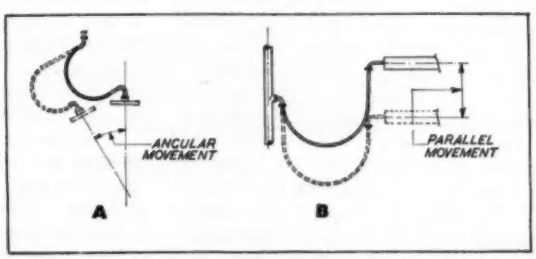


Fig. 24. Methods of installing seamless flexible tubing to accommodate (A) angular movement and (B) parallel movement

In a compressed air system which is run for some time without pipeline filters, it will be found that the inside of the distribution pipes are covered with a mixture of impurities. Filters when first fitted to such an installation must be cleaned frequently, since they have to deal not only with oil and water generated all the time the compressor is running, but also the accumulated impurities.

Continuity of air supply may be secured by either of the methods illustrated in Fig. 25. That shown at (A) incorporates a by-pass pipe, fitted with stop valve (11) in parallel with the filter. Dirty air enters at (9) and clean air leaves at (14). To clean, the filter stop-valve (11) is opened and shut-off valve (10) closed; this ensures an uninterrupted flow of air to (14). Draincock (15) is then opened, when the back pressure from the by-pass line will cause reversal of flow through shut-off valve (13) and the filter, thus blowing condensates and contaminants out of the filter body through the draincock and cleansing the filter surface. By opening stop-valve (11) and closing shut-off valves (10) and (13), the filter is isolated and may be dismantled in situ.

When two filters are installed in parallel in the pipeline as shown at (B), both lines may be used together or independently. This makes possible the cleaning, inspection or removal of either filter without interruption of the flow of filtered air to (8); the inlet for dirty air is indicated at (1). To clean the left-hand filter (4) for example, valves (3), (6) and (7) must be opened and valve (2) closed. On opening the filter draincock, the cleansing action is similar to that described for the individual installation. By closing valve (6), also, filter (4) is isolated and may be dismantled, filter (5) meanwhile supplying clean air to outlet (8). Filter (5) may be cleaned or dismantled in a similar manner, i.e. as in the former case, by keeping valves (2), (6) and (7) open and closing valve (3), and in the latter case, by closing valve (7) also. This type of installation is recommended where continuous operation of the filtered air line is necessary.

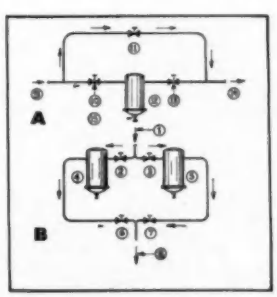


Fig. 25. A continuous supply of compressed air is secured, during the cleaning of a pipeline filter by (A) fitting a by-pass line or (B) installing two filters in parallel

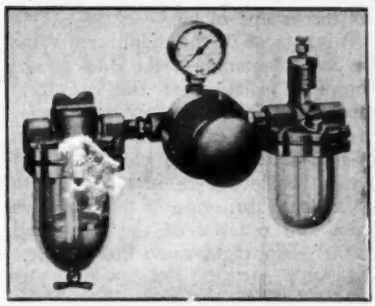


Fig. 26. This "Lang Pneumatic" bowl type filter and oil mist lubricating unit automatically provides oil mist lubrication to all internal parts of equipment reached by air; operating only when air is flowing

By the automatic removal of moisture, oil emulsions, dirt, pipe scale and other damaging impurities from air lines, the incidence or corrosion and abrasive wear in valves and air-operated equipment is reduced. Thus, the application of preventive maintenance to pneumatics also infers the employment of proper ancillary appliances. Advantages may also be secured by fitting automatic lubricators of the type shown in Fig. 26 to lines serving air-operated equipment and production machines wholly or partially powered by compressed air. These produce a regulated air-borne oil fog.

Maintenance of Pipelines, etc.

From the viewpoint of maintenance, copper piping offers many advantages. Outstanding amongst these is ease of manipulation and fitting. Bending to follow the contour of buildings and machines is readily carried out with most sizes of tube by means of hand-bending machines, whilst the smaller sizes can be manipulated by formers of the type shown in Fig. 27. Less unions are required with copper than with steel, thus reducing the number of possible leakage points, and the availability of solderless fittings provides for rapidity of installation.

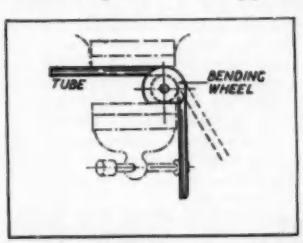


Fig. 27. The cold bending of small diameter tube is facilitated by simple formers of the type illustrated

Use of the latter equipment also results in reduced and easier maintenance. Sound unions are precured and, except in the larger size pipes, there is no need for the use of sealing compounds. The fineness of the thread employed offers more resistance to vibration than does a gas thread, and gives a stronger pinch. Additionally, unions may be slacked back without detriment to permit bent pipe sections to be relocated; alternatively, sections may be completely dismantled and reassembled, without the need for making fresh joints.

Faulty hose should, of course, be immediately repaired or replaced. In some cases, a section can be inserted in a hose by means of couplings to replace a leaking part. In others, leakage may occur where connection is made to the air line, or to the tool or appliance. This, provided sufficient length of hose is available, calls for the refitting of connections only, of which many forms are available. The hose coupling shown at (A) in Fig. 28 provides for easy fitting. When cut to length, the hose is pushed on to the tailpiece. A brass tubular ferrule about $\frac{3}{64}$ in. thick is then slipped over the hose and is secured by rolling one or more grooves in it by means of the tool shown at (B). This is a tube cutter, modified by replacing the cutting wheel by a wheel formed to produce a groove of approximately $\frac{1}{16}$ in. radius.

Air wastage can also often be traced to unsuitable valves or cocks. Here there are several contributory causes, of which entrained moisture is very troublesome. When water is carried through the transmission lines, it washes away the lubricant of the tools and machinery which the compressed

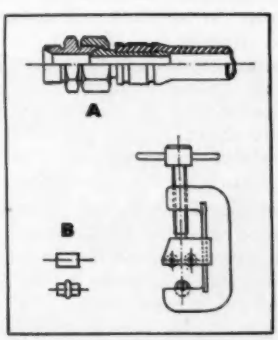


Fig. 28. Hose couplings to B.S. 1906 are recommended. A brass ferrule, grooved by means of the tool shown at (B) secures the hose to the tailpiece

air is servicing. It does the same for many types of valve and cocks that may be in use. The result is inevitable —corrosion, wear on moving parts, escape of air and increased maintenance. This, apart from features already discussed underlines the need for a moisture free air supply.

Valve maintenance is closely allied with selection and installation; the right valve should be used for the service, located for convenient operation and properly installed. Frequent and regular inspections are vital to careful and low-cost maintenance and the more often that a valve is operated, the more frequent should be the inspections. It is essential that servicing be carried out at the first sign of a leak. Such leak may occur at the pipe-valve connections, the valve seat, around the stuffing-box and at the body-bonnet joint. Tightening a leaking joint will often correct the condition. Other remedies are the replacement of gaskets or renewable parts, repacking of glands and regrinding of seatings.

Proper lubrication can do much to prevent valve troubles. This should be carried out to schedule. At least once a month is good timing, whilst, if the valve is in frequent operation, more attention should be given to moving parts. Another practice making for reduced maintenance is the application of a mixture of oil and graphite to the spindle just above the gland. This keeps the stem and packing in good condition to resist frictional wear. Outside screw threads should be cleaned and lubricated systematically.

Servicing will, of course, vary with the valve design; those generally employed with compressed air installations are globe, gate and diaphragm valves, also plugcocks (lubricated and otherwise). The globe valve is undoubtedly the most popular, due to cheapness and ready availability. Its main disadvantage is high resistance to air flow. Maintenance should mainly be directly to the prevention of air leakage at the gland packings. Renewal of working parts is an easy matter, but this advantage is partially offset by the frequency of removal due to grit-collecting pockets that lead to jamming and scoring.

Gate valves when fully open offer negligible resistance to the flow of air. They are not glandless and thus attention must be given to the possibilities of leakages here. Dirt can also cause trouble. Closure is by metal-to-metal contact and hence the tiniest particle of dirt or corrosion products will keep the gate ajar. Minute scratches can again provide a passage for the escape of air.

Advantages of the diaphragm valve are low resistance to the flow of air, complete isolation of the operating mechanism from the flow of air, ease in overhaul, no cavities to trap foreign bodies, and absolute closure at all times. Maintenance is restricted to occasional lubrication of the operative parts and renewal of the reinforced rubber diaphragm when this fatigues. The lubricated plug cock also possesses inherent design features commending its employment in compressed air lines. It is of the full bore type and thus offers little resistance to flow, is quick acting, and, by virtue of its lubrication, should not leak, wear, score or seize. The supply of lubricant must, however, be maintained at all times, otherwise the foregoing features are nullified.

(*To be continued*)

The Card: A Reservoir of Fibres

THE main theme of a recent lecture by Mr. R. T. D. Richards (Wool Industries Research Association) to Batley Textile Society was that of the card acting as a reservoir of fibres. The carding machine was discussed in a different manner from that found in textile books and machine-makers' brochures.

The reservoir of fibres is of the greatest help in producing level yarns. At the output end of the machine the reservoir is insufficient to overcome any irregularity, thus a very high standard of mechanical engineering is required in this region of the machine. Fabric faults have been caused by doffers not being truly cylindrical by less than one part in ten thousand. Further, rollers which are cylindrical must not wander in their bearings although these may be 5 ft. or more apart.

The calculation of this reservoir is important in assessing the mixing power of any form of carding machine and in solving practical carding problems. It is a great help to consider simple analogues. In a typical example, a single-swift carding part was likened to a tank of 40 pints of water with inlet and outlet pipes delivering 1 pint/sec. of water. This is a model of a carding part with a delay factor of 40 secs.

Such models and other theoretical work have enabled research on carding to be speeded up considerably. The model shows that variations from weigh to weigh at the hopper are levelled out by each successive swift so as to be indistinguishable at the condenser of a conventional machine. The model also shows the importance of reliability in a hopper, that is, delivering the same total weight every 5 or 10 mins.

The reservoir can vary with different machine conditions, such as a changed doffer speed. Thus it is necessary to calculate the form of the variations at the tape doffer, even if the variations at the Scotch feed are known. This means that it would be uneconomical to measure at the Scotch feed and to control at the carder web by varying the speed of the doffer since it involves the use of an accurate and reliable computer.

The reservoir of fibres is an important feature of the conventional carding machine. If the other parts of woollen yarn processing remain unaltered, any new type of card must have an equivalent reservoir. The conventional machine deserves all the praise given to it and it cannot be dismissed easily from its vital position in the woollen process. Finally, because of the reservoir, the working points of the card deal with fibres at often ten times the production rate quoted for the machine.

SCOURLESS FIBRE LUBRICANT

A NEW edition to their range of fibre lubricants was announced recently by James Briggs and Sons Ltd., Lion Works, Blackley, Manchester 9. Of special interest to carpet yarn spinners "TN6" fibre lubricant (scourless type) is a water-soluble product which can be diluted with water in any proportion to give clear solutions with good lubricating and anti-static properties for both carding and spinning. Briggs' "TN6" is intended for scouring out under normal conditions in a variety of liquors based upon water only or containing soda ash, bicarbonate, salt, soap, Lissapol N, etc., or combinations of those, including neutral liquors, according to particular requirements.

The firm point out that treatment of the unscoured yarn in baths containing the percentages of acid normally used in dyeing, or in neutral baths, will give residuals which are satisfactorily low, always provided that the grease contents of the wools which form a part or the whole of any blends are also satisfactorily low, and that there is no contamination with other processing oil. Substantial weights of material have now been processed with the aid of Briggs' "TN6" and results have demonstrated its value as a carding and spinning lubricant even in weak solutions, and confirm earlier tests which showed how easily it was subsequently removed from the fibre.

Russian Order for Scragg Machinery

At the recent annual meeting of Ernest Scragg and Sons Ltd., Macclesfield, the chairman, Mr. Ernest Scragg, announced that Russia had placed another order with the company for machinery to the value of £300,000.

Staff Location —One Important Aspect of Modernisation

"Personal Call"—a staff location system—has recently been adopted in some well-known textile concerns with excellent results on productive efficiency and with worthwhile economies

THE present emphasis on modernisation in the textile industry with particular reference to automation in many types of equipment and processes has developed an almost unprecedented feeling for all-round efficiency in the industry. Not only the stepping-up of production in the face of labour shortages and increasing competition but the ability to make the most of limited manpower available will spell success or failure for many mills.

Reorganisation in Lancashire spinning and weaving mills is not in itself a complete answer to the problems facing the industry. Replacing obsolete plant and equipment with its precision-built modern equivalent eliminates major problems but can also create new ones. Not only will less skilled operatives be required to handle the new machinery but the actual management of the mills will tend more and more to be the responsibility of a few key personnel. As can well be imagined, their activities may take them to any part of a premises which has spread beyond all recognition from its original modest extent. The problem of communications now emerges and becomes increasingly urgent as the pace of production increases.

These key personnel—which may vary, according to the size of the mill, from 2 to 20—must remain accessible at only a few minutes' notice, and since they are constantly on the move, it is important to devise a system of contacting them without disturbing everyone else in their vicinity. Moreover—and this is a problem of particular importance in the textile industry—the system must be audible against extremely high levels of machinery noise.

In mills where this problem of communications has been very acute it was at one time common practice for a young employee to be specially detailed to "keep tabs on" certain members of the staff. These could be the works manager, chief engineer, spinning or weaving managers and possibly the electrician and maintenance foreman. But in a mill which may take an hour or more to explore completely, this system has proved no longer practical. Loudspeakers are not very effective in most spinning and weaving sheds and, where they are audible, they tend to disturb other staff.

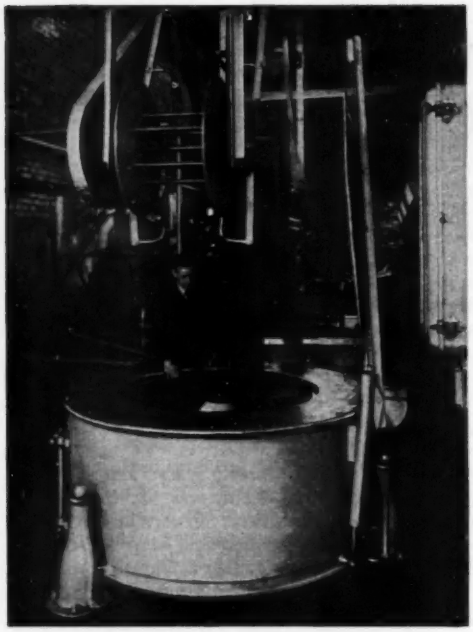
The cost factor is extremely important in those concerns where very high standards of production efficiency are demanded and maintained. With a fully automatic mill prolonged stoppage of even one machine can affect costs appreciably, so that all breakdowns—large or small—must be attended to with the least possible delay.

About three years ago a staff location system was developed for hospitals where, in certain cases, the problem of personal staff location is even more acute, as upwards of 100 people are often required to be "on call." This system, developed by the Multitone Electric Co. Ltd. and known as "Personal Call," consists of a loop or series of loops fitted inconspicuously on the outside of the building or buildings where personnel need to be located. A magnetic field is thereby created in this area, and a transmitter installed at a central point (usually operated by the telephonist) sends impulses over the loops which are picked up by pocket receivers tuned to individual audio-frequencies. This means that only the person for whom the call is intended actually receives it. The receiver, about 4 ins. long and weighing only 6¾ ozs., is usually worn clipped to the breast pocket like a fountain pen.

This system has been recently found extremely applicable in various industries, and notably in textile concerns. "Personal Call" has now been adopted by a number of textile mills including ten in Lancashire, and a cross-section of the industry was recently surveyed to assess the effects of various installations.

(left) The operator and receptionist at Smith and Nephew Ltd. presses a button on the Multitone transmitter to contact someone needed on the 'phone. When the recipient hears his pocket transmitter 'peep" he can contact her in seconds through any of the 65 telephone extensions in the works

(right) The chief engineer and winding overlooker examining the Multitone pocket receiver stood at the side of an "Autocopser"



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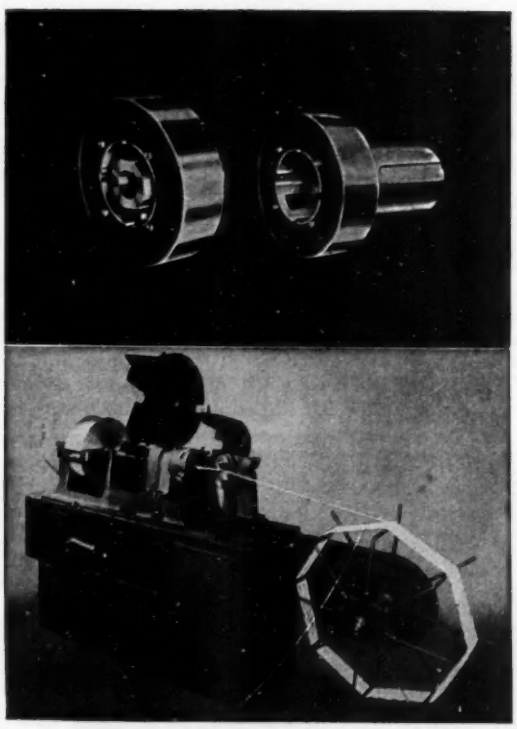

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(left) Equipped with pocket receiver, the production manager at Shepherds Ltd. watches the smooth operation of a new 320-needle tufting machine

(right) The telephonist at John Butterworth and Son Ltd. operating her Multitone transmitter

Three mills chosen varied considerably both in actual physical size and in the particular locations problem encountered. At Smith and Nephew Textiles Ltd., Brierfield, near Nelson, which in the last two years has grown to 385,000 sq. ft. and is built on fourteen different levels, it is estimated that it takes one hour and twenty minutes' fast walking to cover every department in the mill. For 18 months when not only employees in the mill but also architects and builders engaged in construction work were continually being asked for, two girls were employed for the specific purpose of finding people who could not be immediately contacted by telephone.

Then for an external staff locations difficulty as opposed to the internal type the firm of Shepherds Ltd., Ramsbottom, was visited; they occupy two adjacent mills, now devoted completely to the manufacture of tufted bedspreads. This is an unique case because only one person is permanently equipped with a receiver —the production manager—though the office manager will also carry a receiver on his occasional visits to the sheds. Production of candlewick goods is mainly executed to order on a batch system, so the biggest locations problem is with outside customers. In this particular instance examination of costings proved that even a complete installation using one receiver can represent financial savings.

For a mill where the problem was of the 50% each internal and external kind, a typical medium-sized family concern was chosen—John Butterworth and Son Ltd., Waterfoot, condensor spinners and cotton blanket manufacturers. Direct contact has to be maintained here between the managerial staff of the mill and the finishing mill at Burnley, and internally, between directors and mill hands—works manager, mechanic and weaving overlooker.

Lastly, a dyehouse installation at J. Mandleberg and Sons, Salford, offered an opportunity to study the specific problems of location in a dyehouse, where laboratory and office staff had to be contacted at short notice on questions of production.

Cost

A brief study of each installation and a comparison of the relative costings in a small, medium, and large concern immediately provokes an interesting discovery—that whatever the size, the cost per man per receiver does not vary much from 2s. a day. It is possible to work out the costs on a daily basis because the system is most usually installed on a rental scheme. For any mill where it can be proved that the cash benefits derived from the system exceed the cost of the rental, it is obviously an economical proposition, but these reckonings usually omit the convenience factor which is difficult to estimate in terms of financial savings.

For a firm the size of Smith and Nephew Textile Ltd., the cost of renting the system including twelve receivers can be estimated at 2s. 10d. per man per day. But the receivers are actually used on three shifts, each twice on an average during 24 hours; six more receivers are to be added in the near future, which brings the daily cost down to 2s. or 1s. per man. It is worth mentioning here, now that a growing proportion of the industry is starting to work on two or three shifts, that the receivers do not have to be recharged every so often thus putting them periodically out of action. A receiver battery gives about three months' continuous service.

When examining costings it is noticeable that the greater the number of receivers used, the lower the rental charge per receiver. The system is thus especially suitable for a policy of gradual expansion. More receivers can be added without interruptions or alterations, and new buildings and sheds brought into the receiving area at very short notice.

The second firm, Butterworth's, uses five receivers, and the installation covers one four-storey building, three sheds and a warehouse. The present rental is £2 10s. per week or 2s. 6d. per man per day. When the total of receivers is brought up to seven (as happened shortly after the survey), the cost was brought down to 2s. per man per day.

Thirdly, Shepherd's with one receiver pay 30s. per week rental; 6s. per day may seem excessive in comparison but the actual savings achieved are said to be correspondingly larger. It was estimated that one of the office staff used to spend at least 30s. worth of her time in looking for the production manager, whereas she can now concentrate on her proper work. Frequent telephone call-backs, often long-distance calls, are now eliminated. Only two outside lines meant that callers could not wait indefinitely, and delay in answering queries also meant bad customer relations and possible loss of orders. Thus the total net savings were estimated at at least £2 per week. The next stage in the history of this installation will be an extension of the loops to cover a newly-equipped tufting shed besides the smaller shed and the offices. Thus 75% of the whole mill will eventually be covered.

Obviously some firms will realise more actual financial savings than others who mainly estimate the benefits in terms of convenience, but to help an individual firm decide whether or not it is worthwhile arranging for a proper staff location system, free trial installations can be arranged for a limited period.

At Mandleberg's, Salford, the chief problem lay in contacting progress clerks for customer queries and reports,

and occasionally laboratory staff for technical information. Other staff kept permanently "on call" are the commercial manager, the production manager, transport manager, the storekeeper, engineer and chief dyer. Previously it was the office girl's job to locate staff and queries were kept waiting some considerable time. The switchboard operator confirmed that it was not unusual for all ten outside lines to be blocked and frequent call-backs had to be made. In comparison, the Multitone system made her work far simpler and more straightforward. Mandleberg's at first asked for a trial installation using seven receivers and it was discovered they had underestimated the location problem by half; thirteen receivers are now used, and it is planned to allocate one to first-aid department shortly.

A record chart was kept during the trial and an average of 128 calls a day were made through the system. The problem was most acute in the dyehouse itself, and the progress clerks each estimate an average of ten to sixteen calls a day. If one of them prefers to be undisturbed while making up a report he can give his receiver to his colleague who can then deal with all enquiries. Fifty telephone extensions are sited around the premises so that he can make contact in seconds with any personal enquiry. The premises actually wired up consist of a two-storey office block and fourteen sheds or rooms—covering in all 22,500 sq. ft.

It is particularly worth noting that most of the firms visited during the survey had adopted this form of staff location as a natural part of their expansion policy. The larger and more complex the organisation, the more efficient must be the location system, and on the other hand, the fewer the numbers of staff employed, their time is proportionately more valuable. In the case of a man earning £1,000 a year the 2s. spent on helping him to carry out his work with maximum efficiency is repaid many times over by the time and energy saved.

It is worth while recording some of the achievements and plans made by one or two of these firms which are symbolic of the progress now in the minds of all go-ahead textile concerns. Since they took over a century-old mill at Brierfield two years ago Smith and Nephew Textiles Ltd. have spent nearly £2m. on modernisation. Families who were on the point of leaving their home town to seek better prospects now find themselves reinstated in what has become one of the most modern mills in the country. Although practically a fully automatic mill, 1,150 employees now work on three shifts. Staff now "on call" are the managing director, production director, works manager, personnel manager, quality control manager, transport manager, maintenance foreman, foreman electrician, chief engineer, security officer, surgical dressings manager, spinning manager and weaving manager. More receivers are now planned for first aid staff and further maintenance hands. Construction and expansion still continue and the firm is justifiably proud of its work and new equipment which includes the latest type high speed drawframes operating at much higher speeds than the older types, also a unique machine for sizing yarn; a weaving shed lighting system which is automatically switched on when the light value reaches a certain pre-determined figure; continously moving dust-extractors and automatic temperature and humidity control; a moving conveyor serving all departments and carrying all raw materials and finished products; and spinning and weaving machinery representing all the most recent achievements made by manufacturers in Britain and Germany.

On a smaller scale, similar rapid alterations have been made by Shepherd's of Ramsbottom who stopped work in their spinning and weaving sheds last Easter, and scrapped all looms and spindles to make room for the newest 320-needle tufting machinery. The firm was thus well prepared for the autumns' bedspread season, which it would not had it waited to qualify for Government compensation. Tufting was taken up by Shepherd's, using 6- and 12-needle machines, as recently as 1950, and their decision to concentrate on candlewick is a good example of an old firm meeting competition with specialisation.

All the firms surveyed agreed that it would be extremely difficult for them to work without this particular type of staff location system after they had used it for a short while. As a point of interest it has recently been awarded an Intrinsic Safety Certificate. By reason of its extremely low loop voltage, automatic cut-out should any part of the loop be damaged or exposed, and the impossibility of sparks occurring inside the receivers, the Multitone staff location system has proved safe, simple and efficient in operation.

(below) Progress men at J. Mandleberg (Dyers) Ltd., checking at the side of a tentering machine. Both have pocket receivers

(right) Laboratory technician at Mandleberg's can be contacted quickly through his "personal call" pocket receiver

Re-Equipment and Multi-Shift Working

Of vital interest in view of the tremendous changes facing Lancashire, the three papers given at this recent conference discussed every important aspect of re-equipment and multi-shift working, also the economic, managerial and social implications

Implications of Re-Equipment

By R. HODARA*

IT is obvious that one of the keys to the success of a large re-equipment scheme such as the industry is undertaking is to know, much more than what make or specifications of machines is to be bought, what the industry is to produce. You are in direct competition with eastern markets and this fact should strongly influence your policy. For some firms, re-equipment is so important that it will affect not the usual 10 or 15% of the production of the company but a much larger share and if the products produced are not the ones which will sell, somebody is going to be in an awful trouble. Remember, when reasoning on the possibility of a definite market, that lots of companies are going to reason the same way and that, finally, the market you thought was untapped might get clogged.

Three or four years ago the French cotton industry found through surveys, that there was a big potential demand on poplins and most print cloth people decided this was a more interesting line than their usual one. Within eight months, the market was clogged with poplins and this was definitely *not* a profitable line any more. In another example directly related to re-equipment, a series of surveys about two years ago indicated that compared to other European industry, there was in France a very great deficiency of looms (65 to 80 ins.); and that for the same fabrics, the profit on wide goods was 3 to 5% better than on narrow (30 to 40 ins.) goods. Within two years, France practically purchased *only* wide looms with the result that the demand on wide goods is now no better, if not worse, than on narrow goods, and finishing plants cannot dye or otherwise finish a lot of the goods being made. Among those who bought wide looms some are still doing well because they had a traditional market, but some others are sorry they changed their line and this is not a situation which can be easily corrected.

Whether to produce carded or combed yarns, coarse or fine, cotton or synthetics, short or long staple, grey goods or coloured goods, staple products or fancies, plain fabrics or dobby types etc., are questions to be considered before any others are taken up.

Generally, it takes years to get an investment programme right, and many people are much concerned about 1960 and 1961 production. They might tend to do things in a hurry, thus sacrificing the far objective to the immediate result in cost, volume or quality. Once the type of goods to be produced is agreed, the volume has to be determined. This, in turn, means considering shifts. Everywhere in the world, whether we like it or not, most textile machinery *must* run three shifts to pay for itself in reasonable time.

If a mill is going to visualise extensive re-equipment but is not sure enough of its ability to secure the personnel for a third shift, I would strongly suggest they try some other trade to preserve their investment. The larger mill is by no means the most economical in the long run, and it is better to have two or three small to medium mills than one very large one. However, remember that the more vertically integrated the mill is, the better the chance to make a high quality, low price product. Although new buildings may not be needed (and I think in most cases in this district it might be a mistake to invest in new buildings) a sound shell is needed for the producing unit, which means you have to allow plenty of capital for redesigning your buildings, especially taking away all fancy partitions the years may have brought in, laying out your machinery anew, installing efficient air conditioning, insulation, lighting, flooring and accessories.

Generally, when calculating the total cost of your machinery and accessories you find the total exceeds by a large amount your investment capacity. Government grant or no government grant, the problem is to decide what comes first. The first expenses are the non-rewarding ones. As much as possible, equip your buildings, lay out that part of the old machinery which is going to stay for sometime the right way, then plan the new machinery. Every piece of machinery which will be introduced into the new set-up will be made much more valuable than otherwise. This will lead you to decide whether you should re-equip vertically or horizontally. If it is a company of many mills, undoubtedly it should re-equip vertically, i.e., making *one* or more mills completely new.

The problem is somewhat more difficult in a single mill. Although it is still more preferable to re-equip vertically, it is not always possible, and

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one might have to re-equip a complete individual process. For example, a modern slasher will produce up to 1,000 lbs. an hour, i.e. around 100,000 - 120,000 lbs./week (this certainly should run three shifts). Where it was a fairly large mill needing two slashers one could consider modernising only half of the slashing process. The same would apply to scutchers, automatic spoolers, automatic drawing-in, continuous dyeing or bleaching, etc., but for most processes it is still better, even within a single mill, to have part of the production quite modern from raw cotton to finished fabric than to have a complete new department with the input and the output obsolete.

The little piece of modern unit will always produce a good product at a lower price, and if sales decrease production of the obsolete process can always be reduced; in bad times the percentage of goods coming from a modern process is increased and the overall cost will somehow tend to decrease, although the restrictions of production will often counter balance that effect. If on the other hand a department has been modernised all through, it will have some improvement in cost and quality on product but it is not certain it will prove significant and, if and when production has to be reduced, some of your new machinery is idle and not paying for itself.

Assume we have decided on the investment (vertical or horizontal) to be made. Obviously, we do not want to lose a single yard of cloth or lb. of yarn during the change-over. The solutions to this (and none is quite perfect) are varied. If the company owns a large number of mills or buildings, not too far apart, it is probably not running all mills three shifts. So, within certain limits of styles of products and with some transportation problems, it will be possible for some periods to shift part of the production of the mill to be re-equipped to other mills. In this country I have even seen scutcher laps carried many miles by truck in special crates for a mill where a new scutcher room was being installed. Careful planning is needed where the firm only has one mill which must be completely re-equipped or if the products of one mill cannot be transferred to another one. One must remember that in most cases, a new unit installed within the same building as an old unit will in the end (taking into account faster speeds and more shifts) produce much more than the old one. Generally it will also have less machines. Thus the answer is really to start shifting the production to liberate some 10% of the floor available. I know a spinning mill where, in order not to waste any production, moved every frame twice before replacing them by new machines, all in a period of nine months. But it took exactly four people six hours to move a four-hundred spindles frame from one spot to another.

Another point that you should know is what can be done by stages and what not. Thus in quite a few mills, we did choose wood floors rather than concrete because a wood floor on "beams" can be laid in small areas and used immediately, while concrete flooring needs drying and a good job is not done if important areas are not poured at the same time.

For What Machine Life Should We Budget?

Another more critical way is "How long can we relax after making that investment?" Well, it all depends upon the way you look at it. If machinery is used three or four shifts (and four shifts is the solution to a lot of problems) the machinery will be obsolete long before it is worn out, provided it has had a minimum of care. One should not, therefore, budget machine time for too long. On the Continent it was thought for a long time that they could plan all three-shift machinery on a ten years' basis and all two-shift machinery on a fifteen years' basis. To some extent this was balancing the obsolescent effect against wear but in practice this is not true. Machinery planned to work two shifts ten years ago, such as non-automatic winding and spooling, is just as much if not more, subject to being ousted from the mill than looms or spinning frames planned to run three shifts. The true answer to this question is somewhat different. All machinery should be budgeted for ten years' life, whatever the number of hours it is planned to run it.

Maintenance Organisation

Maintenance in a normal well-kept mill is a *line* function. It is the full responsibility of the production manager and all down the line it must be kept in mind that there is no possibility of achieving anything if the people on the spot do *not* have active responsibility for the upkeep of their machinery. Textile machines, even the most modern ones, still need mechanical servicing and for this it is necessary to stop them. There is no straight answer to this as it involves a number of problems. In a typical example in one mill, opening and scutching is stopped every morning for the two hours during which the cost of electrical current is the most expensive and a careful maintenance plan is drawn up so that the work is done in rotation during one week. After spinning frames, scutchers are the biggest consumers of power and here it pays best to stop at peak current cost.

Cards as well as spinning frames are stopped one at a time and serviced by circulating crews because the worker runs 40 cards and 8 spinning frames, and it does not materially affect her load to stop one machine at a time.

Draw- and flyframes are stopped one shift per week (drawframes on Saturday mornings, flyers on Monday mornings) because this 140,000 lbs./week mill has only three drawframes × two times and six flyers, while running three qualities; and it is thought wise to allow some extra capacity for change-overs (it could have bought two half-draw frames and five quarter-flyers) and it can stop the whole production one shift without difficulty. The idea of staggering the stoppages allows for better saturation of the scouring crew and the lost Saturday production of the drawing frames does not unbalance the flyers on Monday morning.

Automatic spooling is also stopped one shift per week but on non-automatic cone winding four hours a week stoppage are allowed for the winders to service their machines under the direction of the mechanic. The reasoning which applies to drawframes applies also to warpers because the mill needs one-plus warper and in fact, has two; and two slashers, because the mill actually needs less than one and has two—one new one—and one which was kept in place in case of major breakdown. In this way the new slasher can always be available when the crew comes to the department. Looms are systematically inspected and overhauled once a year. For a long time this would be done at warp changes but if they needed a major reconditioning there would be "new looms" scattered all around the mill, so now a specialised crew checks the looms one after another.

Effect on Labour Productivity

Do not expect productivity alone to pay for the machinery, but it will certainly make or break the mills which re-equip. We should also recognise that improved productivity

by no means signifies a proportional decrease of labour costs; after all, some of the gains should be given back to the workers. I must say that; I do not believe as some people do that all the savings should be given away but I insist that even if they were, there would still be an appreciable profit to the mill. Consider how much easier it is to set up and maintain a night shift with 50 workers rather than with 100. Even if these workers are paid double (and specially *if* they are paid double) there would be less absenteeism, less labour turnover, and more stable operatives generally more willing to replace somebody on the other shift. This brings us to the next point. If we give each weaver 60 looms what happens when one weaver is missing? On paper this seems as if it would just about lead to the complete collapse of the producing unit. In my experience, generally nothing happens. While a production manager was often caught unawares when operating 8 to 10 looms per worker and would fairly often have one or two sets stopped when somebody was ill, it seems that nobody dares to allow 60 looms to stop suddenly. As if by magic, the manager, the overseer, or workers themselves will find somebody willing to step in.

The key men are a small percentage of the whole mill, and are the most trustworthy people with the best record of absenteeism and turnover. Better trained people are harder to find and, since higher productivity restricts the market for jobs available, it also restricts the demand for such jobs. It thus means that textile workers switch to other activities, and when a key man leaves a new one has to be trained. Training therefore is going to become a more and more important feature of a mill even with less workers.

Nowadays, in a well-run mill (where the worker only has to do the normal chores of its crafts) one can get full production and top quality from a spinner in less than two months, a roving tenter in three and a weaver in three to six, according to the complexity of the looms and fabrics. If a mill is not careful and does not plan long enough ahead, productivity is going to bring a lot of trouble but if it organises for labour scarcity, it will get along all right.

S.D.C. Honour

Mr. J. T. Marsh has been awarded the Perkin Medal of the Society of Dyers and Colourists for outstanding contributions to the practice and to the literature of textile chemistry.

Cotton Board Conference

Implications of Multi-Shift Working

By W. C. CROW*

IT is generally agreed that if the cotton industry is to survive, even—in fact particularly—in its 1959-60 modified form, it can only do so by making the fullest use of its resources of machinery, operative and supervisory personnel, and its technological and managerial skills.

It is appropriate to put the present demand for shift working into the perspective of the employment picture in the industry at the end of 1959. The appropriate figures are therefore set out in Table 1.

Table 1

Section	All Ages No.	All Ages % of Section	All Ages % of whole Industry	Adults (18 and over) No.	Adults (18 and over) % of Section	Adults (18 and over) % of whole Industry	Juveniles (under 18) No.	Juveniles (under 18) % of Section	Juveniles (under 18) % of whole Industry
Spinning									
Men ..	25,820	34·2	11·1	23,780	34·3	10·25	2,040	34·8	0·9
Women ..	49,690	65·8	21·4	45,870	65·7	19·75	3,820	65·2	1·6
Total ..	75,510	100·0	32·5	69,650	100·0	30·00	5,860	100·0	2·5
Waste Spinning									
Men	4,200	57·7	1·8	3,900	57·6	1·7	300	58·8	0·13
Women ..	3,080	42·3	1·3	2,870	42·4	1·2	210	41·2	0·09
Total ..	7,280	100·0	3·1	6,770	100·0	2·9	510	100·0	0·22
Doubling									
Men	4,950	29·6	2·1	4,740	30·9	2·0	210	15·2	0·09
Women ..	11,780	70·4	5·1	10,610	69·1	4·6	1,170	84·8	0·51
Total ..	16,730	100·0	7·2	15,350	100·0	6·6	1,380	100·0	0·60
Weaving									
Men	36,800	39·7	15·8	35,280	40·2	15·2	1,520	31·1	0·65
Women ..	55,910	60·3	24·06	52,540	59·8	22·6	3,370	68·9	1·5
Total ..	92,710	100·0	39·86	87,820	100·0	27·8	4,890	100·0	2·15
Finishing									
Men	30,567	76·1	13·2	29,230	77·2	12·6	1,337	57·1	0·6
Women ..	9,618	23·9	4·1	8,614	22·8	3·7	1,004	42·9	0·43
Total ..	40,185	100·0	17·3	37,844	100·0	16·3	2,341	100·0	1.03
Whole Industry									
Men	102,337	44·1	44·1	96,930	44·6	41·7	5,407	36·1	2·3
Women ..	130,078	55·9	55·9	120,504	55·4	51·8	9,574	93·9	4·1
Total ..	232,415	100·0	100·0	217,434	100·0	93·5	14,981	100·0	6·4

In any discussion it is a good thing to define the terminology in use. Multi-shift working is any method of operating for more than the normal working hours (in the case of textiles 45 hours) in a standard working week. The most commonly used methods of multi-shift working are:—

(1) The combination of normal day operating with a short evening shift. This is known appropriately enough as the "housewives" shift.

(2) An alternating full day and equivalent night shift. The alternation cycle is variable.

(3) The double day shift, compressing working hours into the period permissible under the Factories Acts for the employment of women and young persons.

(4) Three-shift working in which machinery is kept working all through the day. The shifts may alternate all three or two may alternate and one remain fixed. In addition the machinery may be kept running seven days in the week and workers enjoy staggered rest breaks instead of all being off duty at weekends.

Whatever the method, however, the intention is the same—to make better use of the capital equipment in use. The implications also are fundamentally the same. The differences are mainly those of degree.

Political Implications

In numbers employed the main sections of the industry are spinning and weaving. These, along with doubling, account for some 80% of the total employees. In these branches women outnumber men by nearly two to one.

Under existing factory legislation the shape of three-shift working in these is fixed. It must consist of a male night shift working on a permanent basis, coupled with a rotating double-day shift made up of either men or women or a combination of both. If a three-shift system—in the true definition of shift—is to be possible then some changes in factory legislation would be called for. If this is ruled out then some of the social implications become even more forceful. In addition, attention would, it seems, need to be directed at other legislation, e.g. licensing and shop hours Acts so as not to deprive one part of the community permanently of some amenities of so-called civilised living.

Although the purpose of this talk is to promote discussion these items are not within the immediate scope of the members of the conference so they are mentioned mainly as background. In general the political implications might be summarised as an apparent choice between a return to

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lowered standards in employment policies and practices or the adoption of a less stringent attitude to restrictions on individual freedom of activity with some possible attendant dangers.

Social Implications

It is difficult to differentiate between the social and political implications of multi-shift working. Perhaps we might say that the social implications are more concerned with individual or society adaptation to a new pattern of living and the political implications with the rules governing that pattern.

If we accept that changes in employment legislation are unlikely—or undesirable—then particularly in this area of England where a high proportion of employment is still centred in textile production and marketing then large numbers must be prepared to accept a changed mode of living. About one-third of the total industry will have to be prepared to accept an apparently unnatural life of working in the dark and sleeping in the day. The remaining two-thirds will be faced with constant change in their habit of life. One week they will be up with the early bird and the next they will have to confine their evening pleasures to Saturdays mainly, with Sundays problematical because of the need to get up early on Monday morning.

To compensate for this the social community will be faced with the need, for example, to provide facilities for amusement, shopping, transport, etc., all day long and not simply, as now, at restricted times. On the other hand the spreadover of multi-shift working hours can be of great assistance, e.g. to transport organisations by lessening peak loads and by extending in length the peak periods. Socially, therefore, the community might gain.

Another social implication is likely to affect more the younger people in the working community. Unless arrangements can be made for young men and women in their courting days to work the same hours there is likely to be an increase in absenteeism, poor timekeeping and indeed in a reluctance to work shifts at all.

On the other hand married couples with children sometimes find it more convenient to work on opposite shifts on a double-day shift basis so that one of them is always available to take over the domestic responsibilities.

Shift working from the social point of view may also have some effect on health. Most commonly the period of alternation is weekly. But in the interests not only of the individual but of the community at large since investigation of the optimum period should be undertaken.

Economic Implications

Keeping the implications of multi-shift working into watertight compartments with headings is not a very simple proposition. The political aspects spill over into the social, the social into the economic and managerial and so on until it becomes difficult to classify at all lest some item pops up under more than one classification and another equally important gets omitted altogether.

The economic implications are particularly difficult to treat in isolation for they impinge so closely and heavily on all the other three main divisions. As was said at the beginning there is a very widespread feeling that the industry, to exist at all, must operate its machinery on a multi-shift basis. Is this solely because all our competitors are doing so and we feel that to keep in the hunt at all we must do likewise? Or is there a fundamental economic argument for such a course of action?

Superficially at least there is. From the point of view of spreading overheads—providing these overheads do not increase proportionately—it is surely better to operate machinery for 65, 75, 77½, 90 or 120 hours than for 45 hours only.

But of course it is not as simple as it appears. Overheads do increase with each increase in running time. Supervision requires supplementing. Machine wear is greater. Lighting, heating, power are required.

In addition, labour cost per unit tends to increase because of the demand for premium payments to offset the effects on the social and individual life of the community. To revert for a moment to the political and social implications—the increase in machine wear—surely implies some consideration of depreciation allowances—and the increased labour costs merit, in the long term interests of the individual and the community as well as the continuance of the industry, some re-thinking by trade unions of the premiums demanded.

Managerial Implications

All the other implications are problems for managerial personnel in their capacities as citizens and workers. But there are other implications over which managements can exercise more direct control and for that reason are perhaps nearer to the main purpose of this Conference.

The first is supervision. If multi-shift working is adopted without increase in supervisory personnel—in the widest sense of that phrase—it is tantamount to making existing management responsible—on a three-shift basis, for three separate mills. Except at the highest levels and within the functions of administration and sales it is difficult to see how separate shifts can operate efficiently without their own separate supervisory structure. Even so the problems of co-ordinating these separate entities seems bound to produce a more exacting task for top management. Inevitably control from the top tend to be more remote. To counter this top management hours, already often too long, will tend to be longer still and in addition to be even more irregular.

The second major managerial implication is the problem of organising functions such as the personnel, welfare, planning, technical and work study services. Implicit in this also is the need for co-ordination by higher management and the paramount urgency of improved communication up and down the line.

The third implication for management is on the credit side and is of particular interest at this period of increased demand and long deliveries. Multi-shift working does help to provide a better service in the time element to customers.

The fourth major problem for management is that of recruitment. Despite the many prognostications of high unemployment resulting from the redundancy scheme there now seems to be a general agreement that the supply of recruits is less than is required. In this respect, the fact that over the next year or two we shall be faced with an increased and increasing number of juveniles leaving school does not seem to give much assistance in solving this because unless legislation is altered these juveniles cannot immediately be employed on a shift basis.

Summary

The purpose of this talk was not to provide solutions to the many problems of multi-shift working. Rather was it intended to direct attention to them as subjects for discussion. Intentionally, therefore, the tendency has been to stress the problem rather than a solution although in some instances a rather provocative point of view may have been taken. Although for purposes of approach the implications have been mentioned under specific headings it is quite impossible to treat each heading in a completely independent and separate watertight way.

Cotton Board Conference

Role of the Production Engineer

By H. G. GREGORY*

THE role of the production engineer is based on knowledge of the practices, both in this country and in America, and in particular the aircraft industry and the nuclear engineering field. These young industries have grown up on the basis of progressive change in design, materials, techniques, new production methods, and this has stimulated an outlook entirely different from the orthodox and accepted approach. There is a challenge, and a challenge which I feel will be met in the new future which lies before the cotton industry, to introduce a fresh and bright approach.

Definition of a Production Engineer

The production engineer is defined by the Institution of Production Engineers as one who, by reason of his education, training and experience in technology and management is competent to determine the factors involved in the manufacture of commodities and to direct the processes to achieve the most efficient co-ordination of effort, with due consideration of quality, quantity and cost.

(*Continued on page* 108)

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Waste in Spool Axminster Carpet Preparation and Weaving

Waste can arise at several points, including estimating weight allocations, excess wrapping on to spools, guillotining yarn from tubes, tuft overcut during weaving and spools running out in an uneven manner

By P. ELLIS, B.Sc., A.T.I.

OUT of a total of 40 - 50,000,000 sq. yds. of traditional carpet produced each year in the U.K. approximately two-fifths is spool Axminster type. One important reason why manufacturers make spool Axminster carpet could be that there is no theoretical limit to the number of shades and colours that can be put into the pile. There exists, however, the problem of waste yarn made in preparation and weaving, and waste figures of 15% have been stated. Since the average weight of pile per sq. yd. of spool Axminster is about 1 to 1⅜ lbs., then this average percentage would give about 10,000,000 lbs. of yarn waste per annum. The waste is in different forms, one being almost valueless, but others can be re-manufactured or re-dyed, or in one case, woven up again into a form of mottled carpet.

Spool axminster loom (courtesy, Carpet Manufacturing Co. Ltd., Kidderminster, and Platt Bros. (Sales) Ltd.)

Causes of Waste

The main causes of waste in preparation and weaving, in sequence are:—

(1) Excess weight allocation of coloured yarn for a design requirement.
(2) Excess wrapping of yarn on to spools before winding begins.
(3) Guillotining of yarn protruding from spool tubes.
(4) Trimming excess yarn from spools during weaving.
(5) Tuft overcut in weaving.
(6) Spools running out unevenly on the loom.

Excess Weight Allocation of Coloured Yarn

A spool Axminster carpet design may have up to about 70 different colours or shades although many manufacturers employ up to about half this number in a carpet. Each tuft is represented on design paper as a square of colour and therefore, the proportion of each shade or colour in the carpet could be calculated by counting the squares for each colour, and expressing this number as a proportion of the total. If counting is not used but merely visual estimation made, or if the yarn count is not as specified, then estimated yarn requirements may be wrong and more yarn of a particular shade or colour than is required for a particular order is dyed. In practice, even when maximum care is taken, spool Axminster yarn requirements always involve a surplus of yarn for many of the shades and colours used.

The total left over varies between firms and depends largely on the number of shades and colours used in the designs. A firm specialising in elaborately coloured chintz will probably always have more redundant yarn than a firm whose main designs are contemporary with a limited number of colours. A large proportion of this redundant yarn is re-dyed black, since it cannot all be conveniently stored and taken back into normal production. Consequently, although not waste in the strict sense of the word, extra wet processing is involved thereby raising cost and probably affecting quality.

Excess Initial Wrapping on to Spools

Each row of pile across a carpet is made from a particular spool mounted with the rest in a chain above the loom. (Fig. 1). If the quality of the carpet was 7 rows/in. down the length of the carpet and the design repeat 36 ins. long, then there would be 252 spools in the chain. The chain moves slowly around the gantry and each spool is taken in turn from the chain and to the fell of the carpet to deliver yarn for tuft making.

Each spool (Figs. 1 and 2) is virtually a miniature beam of yarn and the

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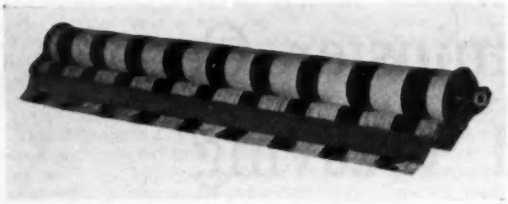

Fig. 2. Full axminster spool with pile yarn threaded through tubes

Fig. 3. Empty axminster spool

length of each thread is about 32 ft. The process of "direct beaming" these spools is known as "Axminster spool setting," or merely "setting." (Fig. 4). Because of the comparatively short length of yarn on the spool every 4 ins. length of the spool yarn sheet represents about 1% of the total on the spool. If the setting operatives do not initially minimise the unweavable yarn put on to a spool, a high percentage of waste may result.

Guillotining of Yarn Protruding from the Spool Tubes

Each thread from the spool passes through a tube (Fig. 5)which, when pile forming occurs, enters the space between each two adjacent groups of warp threads coming from the dents in the reed. The length of pile yarn protruding from each tube should be equal and governs the length of tuft placed in the carpet. The pile yarn has to be threaded through the tubes after the spool has been wound and after this process it should be necessary to guillotine the protruding yarn so that correct tuft lengths will be placed in the carpet at the first insertion of each spool in the chain. Only the minimum amount of yarn should be guillotined away or the resultant waste will be excessive. This form of waste is comparatively short and its value is accordingly reduced.

Trimming Excess Yarn from Spool During Weaving

Yarn is drawn off each spool through the tubes during its pile forming action in the same way as for any negative beam let-off. The yarn drags the spool around against the action of a spring-loaded brake bearing against its flange. Excess yarn which should normally be woven into pile has to be trimmed away due to knots not passing through the tubes. If ends are crossed between spool and tube then there is an increased chance of a knot binding or breaking since the yarn is led in inclined and not parallel to the tube.

In an article ("The Spool-Gripper Carpet Loom," *T.M.*, April 1945, p. 158) the author—Mr. W. Felton—points out that some coloured wool yarns have a tendency to become thinner after dyeing than others of the same count. He goes on to reason that as the yarn is drawn off the spool during weaving, the amount the spool rotates is governed by the smallest diameter, so that the yarns which have been wound to a larger diameter give off more than the minimum required for the tuft, and after a number of tufts have been drawn off the spool, this surplus accumulates between the spool and the tube. The weaver has to draw this surplus yarn through the tubes and cut it off.

Tuft Overcut in Weaving

The pile is formed in the spool (Fig. 6) Axminster carpet by withdrawing the spool from the chain, passing it down tilted at an angle so that the yarn tubes pass (Fig. 7) between the groups of backing threads (warp) in each dent (No. 1). The spool straightens up (No. 2) and moves up and away from the carpet, the sley beats-up the shot of weft around which the tufts will form (No. 3); the tubes, of course, are clear of the backing at this part of the action. The spool then moves up towards the chain for a fixed distance until the requisite pile yarn is drawn off (No. 4). The comb (Fig. 8) then pushes up the legs the tufts (No. 5), and the spool then dwells whilst cutting takes place (No. 6), passing into the chain again when cutting has been completed. The shed changes and the next row of pile is woven in the same way.

If the amount of yarn drawn off from the spool (No. 4) exceeds the requirements for a normal tuft length, then the knives will cut off some of the upturned leg (No. 6). Control of "draw-off" length is by means of a cam which can be adjusted quite simply by tuner or weaver when specifications change. The average tuft length in spool Axminster carpets is about $\frac{3}{4}$ in. so that a 1% waste overcut would be given if the overcut length was 1/133 ins. This sort of waste is almost without value because of its complete lack of fibre length. In practice, there tends to be always a very slight overcut of the pile. Without this tolerance which is slight, there would be a danger that the upturned legs (No. 6) would occasionally be below the required height giving a marked widthways fault across the carpet, known as "short row." The tolerance, however, has to be

Fig. 4. Spool axminster setting frames and creels (courtesy, Platt Bros. (Sales) Ltd.)

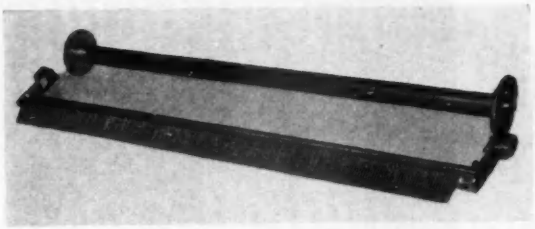

Fig. 5. Empty axminster spool and tube frame

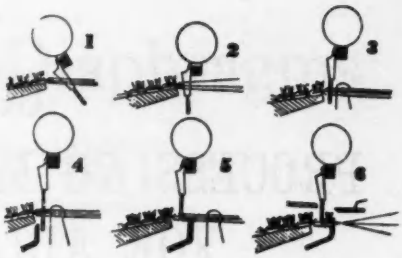

Fig. 7. Sequence of tuft formation in spool Axminster weaving. 1, Spool dipping between chain warp. 2, Upright position. 3, Weft shot insertion and beating up. 4, Spool lifting pile yarn to length. 5, Pile yarns being turned up around weft shot. 6, Cutting of completed tuft from spool

increased as the loom reliability to make specified pile height decreases. Differences of opinion sometimes exist between management and those responsible for the production of fault free cloth as to how much "overcut" should be made to keep down "short rows" to a minimum. It is obviously a vital factor in costing, because $\frac{1}{16}$ in. excess overcut in $\frac{3}{4}$ in. tuft length produces 8% of almost valueless waste in the clean and dyed state.

Spools Running Out Unevenly

The same sort of difficulty is found, as in many other fields of textiles, in weaving out together spools which supposedly all contain the same length of yarn. One factor which enters into all problems of this sort is yarn tension variation occurring between packages. When Axminster spools become empty there are still some in the chain (Fig. 5). containing yarn which could be woven if the complete design formed by the full set of spools was present. It is possible to weave off some of this yarn into a designless carpet but a large proportion of it is put to waste for, reprocessing.

Spool Axminster carpet manufacturers, obviously aware of the problems of waste, are most anxious to eliminate or reduce it to a minimum and operatives, tuners, and management must also all play their part in avoiding as much waste as possible. In conclusion, it will serve a useful purpose to list some of the technical improvements which have been tried:—

(1) Overend delivery of yarns on setting creels instead of side drawing from cheese. This method should make yarn tension more uniform and reduce to some extent the differences in natural length of yarn sheet on spools.

(2) More accurate yarn measuring devices to ensure that the desired length of yarn is wound on a spool.

(3) Longer lengths of yarn sheet on spools which, in addition to helping productivity, ensure a lower percentage waste amount for the yarn not woven at the beginning and end of a spool.

(4) A more efficient braking device for holding the spool during transfer from chain to carpet. This should decrease the frequency of short rows due to the spool rolling up in the tilting action during the transfer, also reduce to some extent the need for excess overcut.

(5) A yarn holding rod which slots into two small holes in the flange, one at each end of the spool. This rod holds firmly the parallel ends of all the threads being initially wound on to the spool, thereby reducing the amount of tangled and unweavable yarn when the spool finishes on the loom.

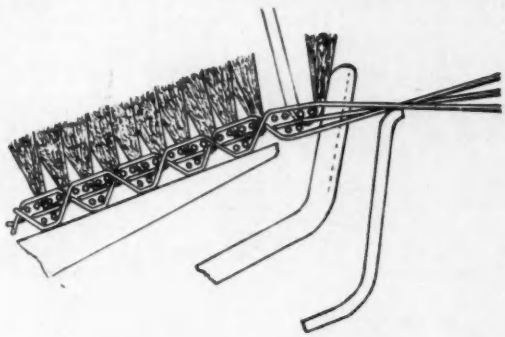

Fig. 8. Tuft turn-up in spool axminster weaving

(6) A grooved holding comb that grips the evenly spaced threads at the end of the full spool. A knife or safety razor blade can be run along the groove to cut the yarn away from the creel; in this manner, termination and start up of a spool are made with all threads level.

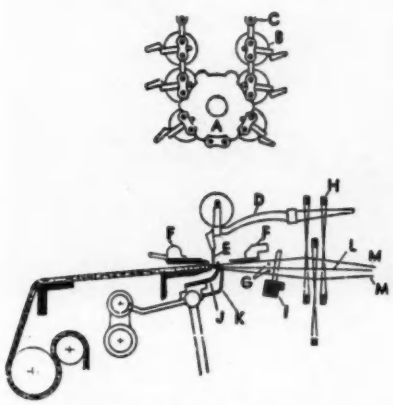

Fig. 6. Side view of spool Axminster loom and part of spool chain. A, chain wheels. B, bobbins and tubes. C, endless chain. D, transfer arms. E, pile yarns. F, knives. G, weft shots. H, heald shafts. I, reed. J, comb. K, dummy comb. L, stuffer warp. M, chain warp

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Value of Statistics to Wool Industry

Statistical information available to the British wool textile industry is among the best—if not the best—available over the whole field of British industry, said Mr. G. Richardson, the National Wool Textile Export Corporation's statistician, in an address to the Textile Institute's Yorkshire section. The industry as a whole was becoming more statistics-conscious, he said, but the available information was still not used as much as it should be by some firms. This was unfortunate, in view of the opinion of an eminent economist that wool textiles was one of the best documented industries in the country, for statistics could make a real contribution to the efficiency and profitability of an industry.

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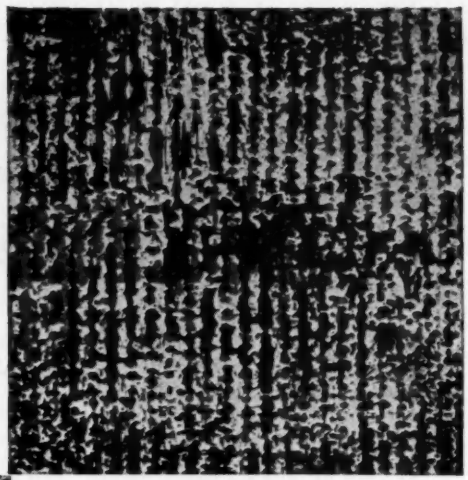

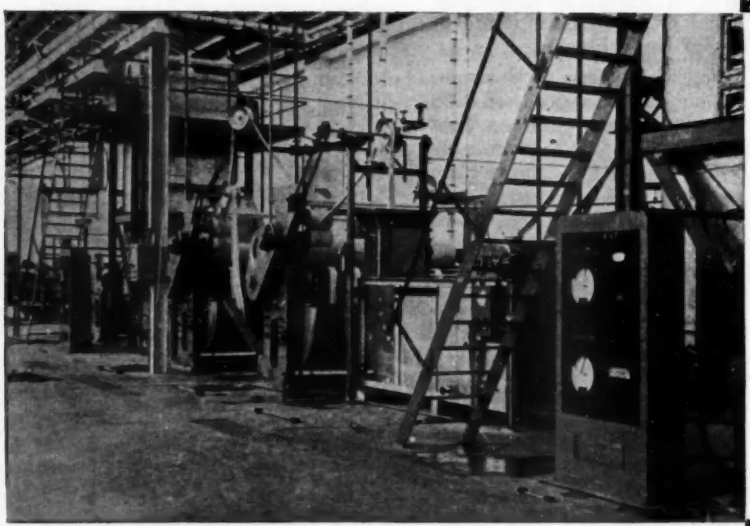

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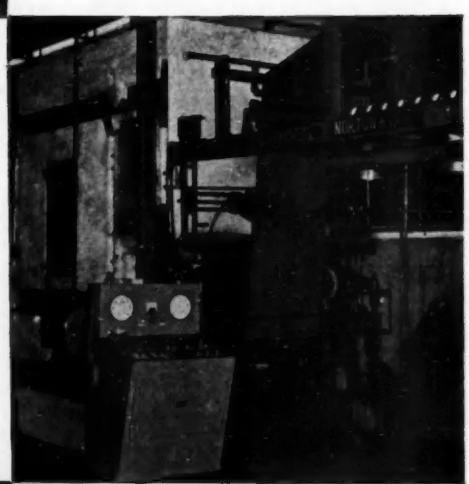

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Coatings and Fabrics for Diaphragms

A list of essential characteristics, together with appropriate design drawings—and the proposed method for the device in which the diaphragm is to be used—helps the supplier considerably to select the best coated fabric for the job

By E. C. HEMES†

WHEN a rubber-coated diaphragm is designed into a new meter, pump or control, the odds are that it will not be the best fabric for the job. This is because of the steady proliferation of new elastomers and base fabrics in the past few years. The result is that many new products are operating with diaphragm fabrics that no longer represent the latest and best in materials. Two basic factors govern the designer's choice: the gas or liquid that will be in contact with the diaphragm, and the operating conditions. This article deals with some of the latest coatings and fabrics, according to the way they respond to these two factors.

Table 1. Effect of Chemicals on Diaphragm Elastomers

Elastomers / Chemical	NR Natural rubber	SBR Butadiene and Styrene	Butyl Isobutylene and Isoprene	Thiokol Organic Polysulphide	Buna N Butadiene and Acrylonitrile	Neoprene Polychloroprene	Silicone Polysiloxane	Hypalon Chlorosulphonated Polyethylene	Viton Hexafluoropropylene and Vinylidene fluoride	Teflon Polytetrafluoroethylene	Kel F Chlorotrifluoroethylene and Vinylidene fluoride	Polyurethane Polyester (ether) and diisocyanate
Aliphatic hydrocarbons	Poor	Poor	Poor	Excellent	Very good	Good	Poor	Good	Very good	Good	Very good	Good
Aromatic hydrocarbons	Poor	Poor	Poor	Very good	Good	Fair	Poor	Fair	Good	Fair to good	Good	Fair
Ketones	Good	Good	Good	Good	Poor	Poor	Fair	Poor	Poor	Very good	Poor	Fair
Lacquer solvents	Poor	Poor	Poor	Good	Fair	Poor	Poor	Poor	Poor	Excellent	Poor	Fair
Gasoline	Poor	Poor	Poor	Excellent	Very good to good	Good to fair	Poor	Fair	Very good	Good	Very good	Fair
Animal and veg. oils	Poor to good	Poor to good	Excellent	Excellent	Excellent	Good	Fair	Good	Excellent	Good	Good	Good
Ozone	Fair	Fair	Excellent	Excellent	Fair	Excellent	Excellent	Outstanding	Excellent	Excellent	Excellent	Excellent
Acids—dilute	Fair to good	Fair to good	Very good	Fair	Good	Good	Good	Excellent	Excellent	Excellent	Excellent	Fair
Acids—conc.	Fair	Fair	Good	Fair	Fair	Fair	Fair	Good	Very good	Good	Excellent	Poor
Alkalis	Fair	Fair	Good	Good	Fair	Good	Good	Excellent	Excellent	Excellent	Excellent	Poor

Effect of the Medium

Whether the medium is liquid or gas, whether it is to be measured, regulated or moved—it is the main factor governing choice of elastomer. The coating protects the base fabric and controls the degree of permeability; and in moulded diaphragms, its stability determines shape-holding characteristics. The diaphragm must remain stable in its original cured condition as long as possible.

A medium can either swell a coating or attack it chemically. Excessive swelling results in excessive softening of the coating—causing the diaphragm to delaminate and to lose shape. The softened coating is then easily damaged by mechanical action. Chemical attack of the coating results in loss of its rubbery properties, either through excessive stiffening or through softening and gumming. Exposure of an elastomer to temperatures above its useful range results in rapid deterioration.

The most common media (air, natural gas, liquified petroleum gas, manufactured gas, water, oil and gasoline) account for about 90% of all coated-fabric diaphragm applications. The other 10% (mainly acids, alkalis, other inorganic chemicals, organic chemicals, and unusual gases) may be regarded as specials needing individual attention.

Clean air and water pose no particular problem except that temperature above the useful range of the particular elastomer will deteriorate it rapidly. Natural and L.P. gases are aliphatic hydrocarbons, and easier to handle than the aromatic hydrocarbons, which are components of manufactured gas. Gasolines should be treated as aromatics because of their constantly increasing aromatic content (up to 40% today). Thus, it is the medium's most prominent and troublesome component that controls the choice of elastomer.

The tables in this article represent the technical opinion of one manufacturer and are intended only as a general guide. Table 1 shows some of the most widely used coating elastomers and their performance in various chemicals. Tables like this one should be used cautiously. The basic elastomers are supplied in many different grades. Buna N, for instance, is available with nitrile contents ranging from high to low—each with different characteristics. Moreover, while the elastomer is the key compound ingredient, performance is also affected by the addition of fillers, plasticizers and other rubber chemicals. Each rubber-coating compound represents a property compromise, usually tailored by the rubber chemist to a particular job.

Operating Conditions

Chemical resistance of the coating elastomer is not the sole criterion of choice. Other operating conditions—pressure flexing, heat, oxidation, etc.—are important influences in coating and in base fibre selection. Table 2 and 3 are guides to behaviour under these conditions, some of which are described here in detail.

Operating pressure determines the diaphragm strength as expressed in Mullen burst pressure, and in tensile strength in direction of warp and fill. Normally it is only the outlet pressure that operates effectively on a diaphragm, except in cases of valve-mechanism failure. The inlet pressure is frequently considered the operating pressure (for safety reasons) in the selection of the diaphragm fabric. The one chosen as design pressure will control diaphragm sensitivity—the higher outlet pressure requiring the stronger, stiffer fabrics.

Effective area times pressure gives the tearing force. At equal operating pressure, a larger diaphragm needs a stronger fabric to resist this force. Larger diaphragms provide for greater sensitivity. Differential pressure, during normal operation, determines the required sensitivity. A thin diaphragm is more sensitive than a thick diaphragm of the same material, but also weaker. A compromise must be struck between the fabric's gauge and strength.

Operating temperature is a critical factor, and both high and low temperatures tend to decrease diaphragm flexibility, though at different rates. High-temperature exposure may cause gradual stiffening and cracking of the coating. For continuous use in the 100- to 200°F. range, special compounds of the more widely used elastomers (Buna N and neoprene) may solve the problem. These can be used intermittently above 200°F. For continuous temperatures above 200°F., special elastomers, like the silicones, fluorocarbons and various copolymers, may be needed.

† *Vulcan Rubber Prod. Div. Reeves Brothers Inc. N.Y.*

Table 2. Comparison of Elastomer Properties

Property	Natural rubber	SBR	Butyl	Thiokol	Buna N	Neoprene	Silicone	Hypalon	Viton	Kel F	Polyurethane
Tensile strength											
Pure gum	High	Low	Med. to high	Low	Low	High	Low	Med. to high	Med. to high	Med. to high	Outstanding
Loaded stocks	High	Med. to high	Medium	Low	Medium high	High	Low	High	High	High	Outstanding
Hardness Range Shore Durometer "A"	30 - 90	40 - 90	40 - 75	50 - 80	40 - 95	40 - 95	40 - 85	40 - 95	60 - 95	55 - 80	60 - 98
Curing Properties	Excellent	Excellent	Good	Fair	Excellent	Excellent	Fair	Excellent	Good	Good	Good
Adhesion to Metals (uncured)	Excellent	Excellent	Good	Fair	Good	Excellent	Good	Excellent	Very good	Fair	Excellent
Adhesion to Fabrics (suitably compounded)	Good to excellent	Good	Good	Fair	Good	Excellent	Good	Good	Good	Fair	Excellent
Compression Set	Good	Good	Fair	Poor	Good	Fair to good	Fair	Fair	Very good	Fair to good	Good
Permeability to Gases	Fair	Fair	Very low	Low	Low	Low	Fair	Low to very low	Low	Low	Very low
Low-temperature flexibility	Excellent	Good	Good	Fair	Good	Good	Excellent	Fair to good	Fair	Fair	Fair
Resistance to:											
Tear	Good	Fair	Good	Poor	Fair	Good	Poor	Good	Good	Good	Excellent
Water Absorption (room temperature)	Good	Good to very good	Very	Fair	Good	Good	Good	Very good	Excellent	Excellent	Good
Oxidation	Good	Good	Excellent	Good	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Very good
Elevated Temperature	Fair	Fair	Good	Fair	Good	Good	Outstanding	Good	Excellent	Excellent	Good
Abrasion	Excellent	Good to excel.	Good	Poor	Good	Excellent	Poor	Excellent	Very good	Very good	Outstanding
Price	Low	Low	Low	High	Medium	Medium	High	Medium	Very high	Very high	High

Table 3. Characteristics of the Textile Fibres Used for Base Fabric

Property	Fibre "Fortisan" Saponified Cellulose Acetate	"Orlon" Polyacrylonitrile	"Dynel" Vinyl Chloride-Acrylonitrile Copolymer	"Dacron" Polyester	Nylon Polyamide	Cotton Vegetable Fibre	Fibreglass Glass	Silk Animal Fibre
Tensile strength	High	Medium	High	High	High	Medium	Very high	High
Elongation	Low	Medium	Medium	Medium	Medium	Low	Very low	Medium
Elastic recovery	Fair	Very good	Very good	Excellent	Excellent	Good	Very good	Very good
Toughness Index	Fair	Good	Good	Very good	Very good	Fair	Fair	Very good
Effect of age	Fair	Good	Good	Good	Good	Good	Excellent	Fair
Electrical properties	Fair	Good	Good	Very good	Very good	Fair	Excellent	Good
Resistance to:								
Moisture	Fair	Good	Very good	Excellent	Excellent	Fair	Excellent	Very good
Heat degradation	Very good	Good	Good	Very good	Very good	Very good	Excellent	Good
Mildew	Poor	Good	Good	Good	Good	Poor to fair	Excellent	Poor
Strong acid	Poor	Excellent	Good	Fair to good	Poor	Poor	Poor	Poor
Weak acid	Poor	Excellent	Good	Good	Fair	Poor	Fair	Fair
Strong alkali	Poor	Poor to fair	Very good	Fair	Good	Excellent	Poor	Very poor
Weak alkali	Fair	Fair to good	Very good	Fair to good	Good	Excellent	Fair	Poor
Organic solvents	Good	Fair	Poor	Good	Good	Excellent	Excellent	Good
Flammability	Poor	Fair	Good	Fair	Fair	Poor	Excellent	Poor

Low-temperature exposures in the 0 to —70°F. range require special compounding of regular elastomers to maintain coated fabric flexibility. Below —70°F., natural rubber can serve if the medium permits it. Otherwise special synthetic elastomers (primarily the silicones) will have to be used.

Flange design affects the gauge of coated fabrics and sometimes toughness of coating, especially when heavy compression is encountered. The most frequent failure of diaphragms is tearing at the flange bolts. Therefore, when flange pressure is low and uneven, because of too few bolts or a thin flange cross-section, a stronger base fabric must be selected. In new designs, the flanges should be designed to accommodate the ideal diaphragm fabric. Corrugating or embossing of flanges can permit choosing thinner coated fabric.

Anti-wicking properties have to be considered when seepage can occur across clamping areas. This can happen when a diaphragm edge is exposed internally to high pressures. The seepage can be prevented by special anti-wicking treatment of the base fabric. However, such treatment raises cost of the coated fabric and somewhat reduces its flexibility, so should be employed only if absolutely necessary. The more closely woven, high-count fabrics are better for anti-wicking, and vegetable fibres more easily treated than synthetics.

Rapidity of pulsation affects the bond between coating and fabric. If the diaphragm pulsates at high frequency, choose a coating with particularly good ahesion to the base fabric, and with high abrasion resistance. Relatively strong base fabrics are usually indicated. Rapid pulsation rules out fibreglass as a base fabric because its ductility is low.

The ratio of effective area to length of stroke decides whether a flat or a moulded diaphragm is needed. Moulded types, which cost more, are preferred when a flat diaphragm will not give sufficient travel without resistance or distortion. When a moulded diaphragm requires a deep draw, synthetic fabrics are usually chosen because they are stronger for a given flexibility. Most elastomeric coatings mould with equal ease, except for occasional problems with mould release.

Dimensional stability is vital in all metering devices; here, both coating and base fabric must have this property to highest possible degree. The same stability is also important in some other devices.

Tables 2 and 3 suggest other physical requirements, which occur less frequently. Catalogue data on coated fabrics for diaphragms usually cover style number, elastomer, base fabric, gauge, tensile strength, Mullen burst test, and weight/sq. yd. as a guide. If M.I.L., A.M.S., S.A.E. A.S.T.M. or underwriters' laboratories' specifications must be met, it is better to consult the coated-fabrics manufacturer.

Cost and Availability

Two other important factors, cost and availability, are often related to each other. "Specials" are expensive if the fabric must be coated in small quantities; the supplying plant usually has difficulty scheduling them and making early deliveries. A standard stock item can easily become a "special" through a minor change in performance requirements. If cost is a consideration, only essential performance requirements should be included in diaphragm specifications.

The best approach is first to list the "must" characteristics in the order of their importance, then add other characteristics that are desirable but not absolutely essential. This information, together with a set of design drawings and the proposed test methods for the device in which the diaphragm is to be used, will help the diaphragm - material supplier select the best coated fabric at the best price and delivery.

Bradford's Yarns and the Hosiery Industry*

The knitted outerwear trade is one section of the hosiery industry in which considerable expansion has taken place in recent years. The trend towards casual clothing suggests that easy fitting knitted garments will retain their popularity.

By W. A. DUTTON, F.T.I.†

WOOL is used for almost every type of knitted product and nearly every variety of article has, or is being manufactured from wool yarns but changes do occur. In footwear, the inroads made by nylon in the ladies' hose field are well known. Nevertheless, a small proportion of wool hose is made, principally for use by elderly women, also by sportswomen. Opportunities may exist for the development of fine wool yarns for use in making serviceable hose for everyday wear. The magnitude of this challenge however will be appreciated from the fact that 60-gauge hose is made on a machine having 80 knitting elements to the inch, and the diameter of the yarn must be such that it will pass between these needles and sinkers. With men's footwear the position is more favourable to wool. Recent years has seen first a movement towards the increasing use of synthetic fibres, but more recently there appears to be a reversing trend towards wool yarns. This may be a fashion trend but socks represent an important outlet for wool yarns in the hosiery industry.

The underwear field is alive with possibilities for both wool spinner and knitter. The heavier types of wool underwear so popular at the beginning of this century have now almost completely disappeared. This is because of improved living and transport conditions, and the general desire for lighter weight clothing. It will also be remembered that the first world war saw the introduction of the interlock machine, producing what is often known as double rib fabric which is now the bread and butter line for underwear, particularly men's and children's. The most common yarns used are cotton and cotton/rayon blends, the popular counts being 1/26, 1/30, 1/35 and 1/40 cotton. In the case of ladies' underwear, shaped wool, and wool blends are still used, and the synthetic fibres have entered the field.

In speaking of possibilities in the underwear field I mean the increasing exploitation of new knowledge concerning the thermal characteristics of fabrics. For example, Scandinavian brynje type vests were used successfully by some of our troops in the last war, yet the important principles involved in these structures have only been used in peace time to a very limited extent. The Americans are now beginning to exploit this idea, and it seems likely it will catch on in this country later. Wool is eminently suitable for underwear, and used in conjunction with new ideas on fabric structure to give warmth without weight, there is ample scope for new fabrics in the underwear field. In such developments however, wool fabrics must stand comparison with other materials which are quick drying, non-shrinking, etc.

That part of the hosiery industry which has shown the greatest expansion during recent years—and incidentally has used increasing quantities of wool—is the knitted outerwear trade. In the various sections, e.g. circular, fashioned, milled jersey, etc., there has been pronounced expansion recently. The trend towards casual clothing and increased leisure suggest that easy fitting knitted garments will retain their supremacy for outerwear and the future would appear set fair for knitters and spinners concerned with the manufacture of such articles. At this point I must emphasise the fact that most hosiery manufacturers are always ready to experiment with new yarns. In this matter it is worth remembering that many knitting machines are so adaptable that even with a single cone of a new yarn a knitter may be able to produce a garment. Here the knitter scores over the weaver, who must have beams, etc., prepared for sample fabrics.

Problems

The problems to be considered by the knitter using wool yarns may be classified as (*a*) economic and (*b*) technical.

Economic.—It is, perhaps, worthwhile to look at one of the more important aspects, i.e., price stability. I am the last person to speak on wool prices, but I know of cases where knitters have been driven to using other fibres owing to price changes in wool yarns. Compare these fluctuations with the controlled prices of synthetic yarns and one can readily appreciate an important attraction of man-made materials.

Technical.—The most important technical problem is that relating to dimensional irregularities in knitted articles. This is not peculiar to wool or to any one form of knitting but it is a troublesome problem from which other difficulties and faults emanate. For the purpose of defining this problem my remarks are confined to wool socks.

Men's wool socks are made on machines in which the number of rows of loops or courses knitted into each sock is governed by a chain, each link being equal to a fixed number of courses. Hence, on any one machine, each sock must have the same number of courses and the sock dimensions should be constant. In practice, this is not the case as considerable variations in the sock sizes are encountered. These variations result from a multiplicity of causes, known and unknown, which may be classified as (*a*) yarn variations, (*b*) knitting variations and (*c*) dyeing and finishing variations. Of these, knitting plays the greatest part.

Yarn Characteristics

It is appropriate to analyse some irregular articles by comparing the course lengths and, therefore, the stitch lengths. Such tests show that invariably a change in sock dimension is accompanied by a change in course length, the larger the sock the longer the course or loop length. Therefore any factor which changes the course length, also changes the garment size.

How can the wool yarn change the course length? Amongst the more important factors are tension and friction. Tension changes may be brought about by poor adjustments in such items as disc tension controls on the knitting machines. In other cases bad winding may result in irregular off-wind tensions. Long-term variations in yarn tension during knitting tend to show as changes in actual garment dimensions. Short-term fluctuations appear as either a tighter or slacker series of loops in the fabric.

Tension can also be influenced to a marked extent by the frictional properties of yarn and yarn friction is influenced by many factors, a common one being moisture content. Any unevenness or excessive water in a yarn can be most troublesome to the knitter, not only during knitting, but also where garment dimensions are concerned.

This raises the old problem of the official regain—18¼% for wool. One of the best reasons advocating a reduction is associated with this problem of different knitting stiffness and moisture content. Yarns conditioned by spinners to 18¼% regain lose moisture during transit and storage. At the time of knitting there may be a gradual change in moisture content from the outside to the inside of a cone. Ideally moisture content should be constant throughout.

The frictional properties of dyed wool yarns vary appreciably according to the method of dyeing. Knitters generally find that darker shades have higher friction and usually knit tighter than yarns dyed in lighter or pastel shades. Yarn friction may

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* *From a paper given recently to Bradford Textile Society.*

† *Director of Research, Hosiery and Allied Trades Research Association.*

** *In the absence of Mr. Dutton this paper was presented by Mr. T. S. Nutting.*

be reduced by suitable lubrication, and a common technique is to wax the yarn. Under ideal conditions—as yet somewhat difficult to specify—drag on yarns can be reduced. Unfortunately, many wax lubrication systems and their supervision leave much to be desired, consequently the proper conditions are not obtained. Under such circumstances it is possible to aggravate the fault.

From these simple examples it will be appreciated that certain yarn characteristics have an important bearing on the knitters most important technical problem. But what can the knitter do himself about these variations? We have already seen that dimensional variations are associated with loop length variations, therefore, if the loop size is kept constant the garment size will also be regular. To help knitters maintain a constant loop size, H.A.T.R.A. developed techniques which may be classified as (*a*) manual methods of control, and (*b*) automatic method of control.

Automatic Methods of Control

Although it is not possible at this stage to divulge details, the Research Association has developed automatic means of ensuring that a constant length of yarn per loop is maintained. Where socks are concerned, this form of control ensures them being made within fine dimensional limits. The equipment overcomes those variables which normally influence the length of yarn knitted into a loop. These new control units can be attached to most types of knitting machines and a number are now in commercial production.

The effects of the dyeing and finishing processes on the size irregularities are related chiefly to release of knitting strains and to methods of handling. Prolonged or over treatments, can in the case of wool goods, bring about felting and thus influence the garment dimensions by shrinkage.

Pilling

Another problem sometimes encountered by the knitter of wool yarns is the defect known as "pilling" (formation of small balls of fibre on the fabric surface). We believe complaints due to this fault have increased considerably over the past few years. This, we believe, is not due to any deterioration in the ability of the knitted fabrics to withstand pilling, but rather an awakening of the critical instincts of the public, possibly encouraged by publicity on this particular aspect of knitted fabrics.

Pilling is not a problem to be solved by simple spot tests and measurements. It has been a source of trouble too long for all simple expedients not to have been tried already. Only by fundamentally exploring the problem and by ascertaining the relative importance of the yarn and fabric properties which may contribute to this fault can any progress towards solving this problem be expected.

H.A.T.R.A. is investigating this problem and an interim report on the progress made is interesting. An essential first requirement for this type of work is a means of reproducing pills under laboratory conditions. This involves first an analysis of the pills. Work undertaken has resulted in the H.A.T.R.A. pill tester and with this reliable instrument the way is open to assess the influence of such characteristics as wool quality, diameter, staple length, etc. The findings of our work so far show:—

(1) That slackly knitted fabrics pill more readily than those tightly constructed.
(2) It is generally believed the pilling resistance of a fabric can be improved by using more highly twisted yarn but experimental evidence does not confirm this belief. Using yarns of similar count and quality but twisted to different degrees, no significant improvement has been obtained by using higher twists. These observations should be considered against the relatively limited twist limits normally permissible for hosiery yarns.
(3) Pilling is markedly increased after wet processing, probably as a result of agitation and loosening of the fibres during treatment.
(4) Pilling usually becomes more severe as the fibres increases in fineness.
(5) More hairy the yarn and greater the liability to pill.

Further work on this subject is in progress.

Shrinkage

Considerable progress has been made during the last 20 years or so in developing improved shrink resist processes for application to wool fabrics. Many are extremely satisfactory and from the consumers' point of view do prevent felting and matting of the fabric surface. Nevertheless, cases of shrinkage and dimensional instability are still found. Close examination of such garments often shows that shrinkage has occurred without felting. In these cases loss of size can be attributed to physical factors, e.g., fabric structure.

Earlier work has shown certain relationships which exist between the density of knitting and the relaxation and felting shrinkages. More precise knowledge of the geometry and behaviour of knitted fabrics has been derived from basic studies at H.A.T.R.A., and a better understanding of the performance of knitted wool fabrics during manufacturing and use has been obtained. Briefly, these findings show that during manufacture a knitted wool fabric may be subjected to many strains due to the various tensions applied during knitting. These strains would be removed during suitable wet processing conditions (e.g., dyeing and finishing) but, unfortunately, the equipment used may introduce further strains which are temporarily set in to the fabric. Thus the final garment may be made-up of fabric in a stretched state, and shrinkage will occur as the fabric relaxes during washing. Such shrinkage cannot be arrested or prevented by chemical shrink-resist finishes and the fabric will only become stable when in a completely relaxed state. We know the fabric relationships which exist when this fully relaxed state is reached and are taking steps to produce fabrics in the fully relaxed state.

Role of the Production Engineer

(*continued from page 101*)

Function of Production Engineer

The production engineer's function is concerned with everything necessary to produce—from design to the finished product, embracing consultation at the design stage, production development, or pre-production planning, process planning, production control, design responsibility for jigs, fixtures and tools, materials handling, and provision for inspection.

Qualities

The production engineer is competent by virtue of education and training to apply the scientific outlook to production engineering problems, with personal responsibility for development and application of production engineering science and knowledge. Among many personal qualities should be leadership ability, analytical ability, good judgement, a desire to work with people, and he must above all have an open mind.

How We Recruit Them

Production engineers become available in three ways—through technical colleges and universities, post-graduate courses, and apprenticeship with Higher National Certificate in production engineering, plus endorsements. To retain these young men, the answer is that the young man who is suitably trained and qualified should be given a real job of work to do and given responsibility, and let him prove his worth

The policy of the Institution of Production Engineers to broaden its base has been actively pursued over the past few years, as production engineering in its original concept was applied principally to the metal cutting and metal forming industries. However, as we all know, industries such as boot and shoe manufacture, pottery, and of course cotton, etc., are those where the philosophies of production engineering can be pursued. The Institution's Education Committee has for several years now been actively examining requirements of other professional institutions where subjects of like-for-like can be accepted and therefore exempted as qualifying subjects for the Institution of Production Engineers.

The days of the works manager being the end all and be all in modern industry has passed long ago. New technologies, new sciences, demand an application divorced from the everyday running of a works, mill, or what have you, and I believe that from the research laboratory, the design office, through to the production stages, the production engineer really comes into his own. If the cotton industry's management is going to face up to its reorganisation, then they must be qualified in management to do so. Unless they go out and get these young men, they will lose them to industries such as my own.

New Dye for Printers

Procion Scarlet HR, the latest addition to I.C.I. Dyestuffs Division's reactive dyestuffs, is a bright, homogeneous scarlet of good light and wet fastness. The new dye, expected to find its principal value in the textile printing field, can be applied by the normal Procion "H"-brand printing recipes to cellulosic fibres, chlorinated wool and natural silk to give attractive full scarlet shades. The makers will gladly supply enquirers with samples of the new dye and technical data.

TEXTILE MACHINERY and MILL EQUIPMENT NEWS

New Development in Spinning and Doubling Spindle Design

The space occupied by bearing and damping components in this spindle insert permits the bolster and wharve diameters to be smaller. Increases in spindle speeds of up to 25% are claimed without increasing the speed of other driving elements.

BECAUSE of the increasing trend to adopt methods of building heavier yarn packages at higher speeds, a great deal of work has been done by SKF on spindle design, culminating after extensive trials in spinning and doubling mills, in the introduction of the HF type spindle insert. With this insert oil damping only is employed and wear is said to have been eliminated to such an extent that the spindle need only be re-lubricated about every 20,000 operating hours. The load carrying capacity of a spindle with an HF insert is claimed to be about five times that of a spindle with a damping sleeve insert (Fig. 1) and three to four times that of a spindle with a brake ring insert (Fig. 2). A spindle with an HF insert runs extremely smoothly and spinners and doublers using this type spindle can be assured that any deterioration of the bobbins—which cannot be prevented—will have little effect on the operation of the spindles.

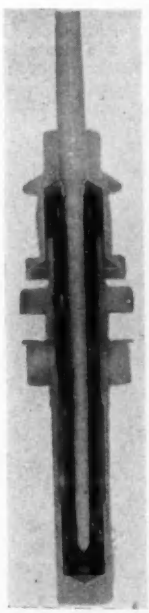


Fig. 1. Spindle with damping sleeve insert

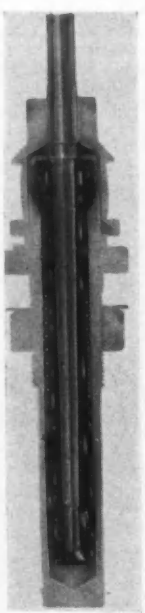


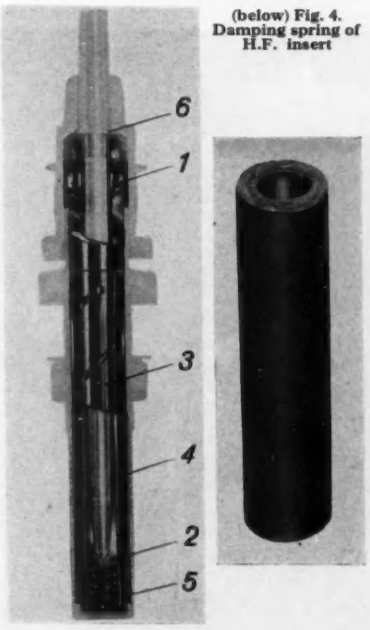
Fig. 2. Spindle with brake lining insert

The HF insert (Fig. 3) has a conical seating which is a press-fit in the spindle bolster neck. Roller bearing 1 and footstep bearing 2 are housed in sleeve 3 in which a helical slot provides a degree of flexibility. The lower part of the sleeve is enclosed by damping spring 4 which is a wide spring steel band formed into a number of precision-wound coils with annular damping gaps of constant width; this damping spring is shown fully in Fig. 4. The spindle oil that fills the annular gaps serves the double purpose of lubricating and damping.

Spindle blade vibrations cause the flexible sleeve to be deflected from its central position in the bolster and so compress the damping spring. The width of the damping gaps is reduced and oil is displaced. As the oil opposes displacement the flow becomes turbulent and provides a damping effect which reduces the vibratory movements of the sleeve, the footstep bearing, and the spindle blade. In other words, vibratory energy is dissipated by fluid friction.

An important feature to which the makers draw attention is that damping is not uniform for all speeds but increases with speed. In a spindle passing through the first critical speed range—varying between 1,000 and 2,500 r.p.m., depending on spindle size—the rate of oscillation of the sleeve is comparatively low. Accordingly the flow of oil within the coils of the damping spring is also low and the damping action is proportionally limited. When vibrations occur the damping system responds immediately and the damping effect is quite smooth. In other words, the flexibility of the sleeve is only slightly reduced at this stage as the damping forces developed by the coil spring are still limited. This is important to overcome sympathetic vibration of the spindle blade, which is a phenomenon that is felt increasingly as the spindle bearing becomes rigid in the bolster.

An HF-equipped spindle passing through the first critical speed range will show very little—and in many cases scarcely noticeable—sympathetic vibration of the spindle blade, while higher critical speeds will not make themselves felt at all. As the spindle speed rises, the rate of oil flow



(below) Fig. 4. Damping spring of H.F. insert

Fig. 3. Spindle with H.F. centring sleeve insert showing 1, roller bearings; 2, footstep bearing; 3, centring sleeve; 4, damping spring; 5, coil spring; 6, spindle blade shoulder

within the coils of the damping spring increases resulting in intensified oil turbulence. This increases the damping forces and provides a firmer damping effect because the flexibility of the sleeve within the bolster is reduced. Consistently smooth running of the spindle in the normal speed range is ensured and disturbance due to vibration of the spindle rail or strong, uneven, yarn tension, for example, is eliminated.

The method of damping employed in the HF insert is capable of automatic adjustment to suit varying operating conditions, smooth damping being provided in the critical speed range and firm damping at normal speeds. Footstep bearing 2, which is pressed against a stop face in sleeve 3 by coil spring 5, has some freedom of movement in an axial direction, and this feature prevents damage to the footstep bearing, the step point of the blade, and the sleeve when the blade is dropped into the bearing or is otherwise forcibly inserted.

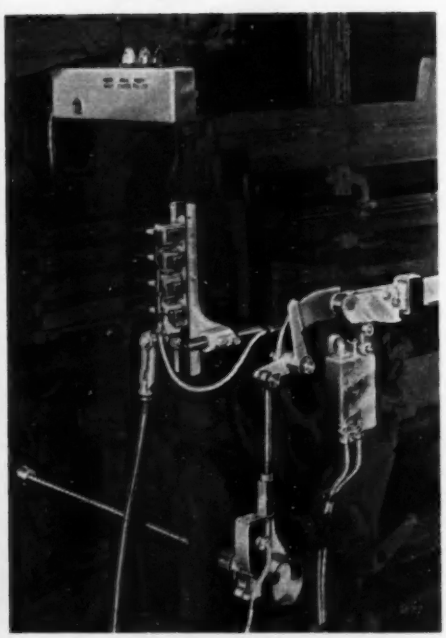
If subjected to axial pressure through the spindle blade, the footstep bearing will move downwards in the sleeve against the pressure of the coil spring until the spindle blade shoulder 6 comes into contact with the upper face of the insert.

The HF spindle operates with equal efficiency under normal and extreme load and/or speed conditions, and with its operating speed range of up to 20,000 r.p.m., it has a considerable speed reserve. In fact, the maximum speed possible in practical operation is no longer determined by the limitations of the spindle itself but now depends on other factors, such as the maximum traveller speed attainable on a ringframe.

Because the bearing and damping components in the HF insert take up little room the bolster and wharve diameter can be made quite small. This, the company say, means an increase of up to 25% in spindle speed without it being necessary to increase the speed of the driving cylinder, the tension pulleys and the tape. If increased spindle speed is not required, then the adoption of spindles with HF type inserts will enable a reduction of driving cylinder speed which will mean an appreciable reduction in the power consumption of the spinning or doubling frame. The minimum wharve diameter possible for a spindle with an HF type insert on a cotton ring spinning frame or a light-type doubling frame is $\frac{11}{16}$ in.

Improved Multi-Box Weft Feeler

THE multi-box electric weft feeler motion made by George Hattersley and Sons Ltd., Keighley, has been in quantity production for several years and up to the end of 1959 over 1,000 units of this reliable mechanism had been sold for fitting on the company's "standard" and "light standard" looms, also Dobcross, either 4×4 or 6×6 box. This device, which eliminates the need for a weaver to watch the shuttles on pick-at-will looms, is finding wide popularity in West Riding mills, where three- or four-loom weaving is becoming increasingly popular.



Multi-box weft feeler mounted on the left side of Hattersley's standard model underpick loom

The loom is stopped at back centre, with the nearly exhausted shuttle level with the raceboard, at the opposite side to the feeler. The weaver has merely to remove this shuttle, replace it with a full one and re-start the loom. Shuttle reloading is simplified, as it does not require re-threading. It is pointed out that these advantages, combined with the provision of a warp stop motion, allow true semi-automatic weaving with no sacrifice in quality or versatility and reduced waste. Of greater importance, it is claimed to make possible reductions in weaving costs of over 25%. This feeler motion is stated to have largely eliminated the call for a pick-and-pick automatic loom.

The demand for a more accessible knock-off mechanism has led to the device being repositioned at the front of the loom where it now takes its drive from the take-up shaft. As this shaft is reversed during the pick-finding cycle, it follows that there is no risk of the loom being stopped inadvertently whilst this is taking place. The control panel has been placed at the same end of the loom as the feeler, and signal lights have been incorporated therein. It will be seen from the illustration that the close grouping of the three main units which form this system, greatly simplifies wiring and installation. The signal lights, a valuable aid to the weaver, warn her of the action she must take as she approaches a stopped loom. Different coloured lights normally supplied for warp break, weft break and weft feeler, are automatically cancelled when the loom is restarted.

An additional feature is the provision of a stop-button in this panel, which stops the loom in a set position. Other buttons can be arranged behind the loom. Electric warp stop motions working in conjunction with this feeler, can utilise the same transformer, knock-off motion, etc. The feelers remain unaltered, they comprise four individual two-prong units mounted in nylon blocks, carried in a vertical slide. The arrangement is such that if a rising box jams, the feelers are undamaged. Individual feelers are, however, easily replaceable.

Saxl Tension Meter

THOMAS MERCER LTD., Eywood Road, St. Albans, Herts, have acquired the U.K. manufacturing rights of the Saxl tension meter from Tensitron Inc., Harvard, Mass., U.S.A. Although mainly used in the textile industry for accurately assessing yarn tensions, this instrument is widely used in many branches of industry where accurate or known tension of tape, wire, cord, nylon, etc., is desired.

It is particularly useful for the precise winding of wire for small electrical components. Made in four types which cover a range from 0 to 1,000 grams, the meter is trigger-operated, has grooved tension and guide rollers for ease of application, and gives stable readings in any position.

Colour Matching Unit

A REDESIGNED Siemens Ediswan colour matching unit, produced by the Lamps and Lighting Department of A.E.I. Radio and Electronic Components Division, will find applications in many industries—e.g., colour printing, yarn and fabric matching, etc.,—where a light source accurately simulating North sky daylight is required. Colour Matching Unit F221/43 employs two 2 ft. 40 watt special blue fluorescent Sieray lamps and two 60 watt pearl single coil gasfilled filament lamps. Their output is blended and diffused within the unit to give a spectral quality almost identical with that of natural daylight at a colour temperature of 6,500–7,000°K. The diffusing window measures 23¼ ins. × 17 ins. and is a large area source of low brightness which compares with a window illuminated by natural daylight. The unit consumes about 220 watts and produces about 3,000 lumens Samples can be examined under illumination intensities of between 45 lumens/sq. ft. on a plane 3 ft. below the window, and 20 lumens/sq. ft. 5 ft. below. Control is effected by a three-position switch with Northsky daylight, tungsten lamps only, and off positions. Thus, samples can be examined under incandescent light alone if desired. If the user wishes to examine samples under light approximating to equal energy, the 60 watt incandescent lamps can be replaced by ones of 100 watt rating.

Fabricated in mild steel sheet of welded construction, it is finished externally in an attractive mushroom coloured stove enamel internally in white stove enamel. It measures 24½ ins. long × 18¾ ins. deep × 14¼ ins. high, and, with gear and lamps, weighs 30 lbs. It is suspended from stout wire clips which hook into the louvres at each end of the unit. The unit is supplied fitted with a tapped choke suitable for operation from 200–250 volts, 50 c/s ac. Choke tappings are 200–210, 220–230 and 240–250 volts. Units can be manufactured for other supply voltages to special order. Power factor with 60 watt G.L.S. lamps is approximately 0·7 at 230 volts and 0·65 at 200 volts. A power factor correction capacitor is not normally supplied but a single CH.400 capacitor will correct to 0·85.

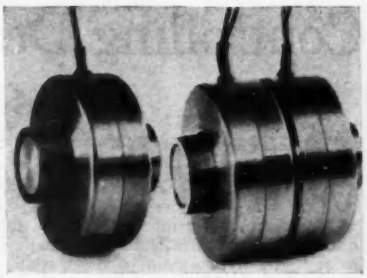
The locus of the mixture of blue fluorescent and incandescent light from the unit follows closely the black body radiation locus in the region 5,000–8,000°K. This indicates that if the proportions of blue and incandescent light vary a little during the life of the lamps, the colour temperature is slightly changed but the black body colour (and spectral distribution) is maintained at the new colour temperature within a very close tolerance. Such colour temperature variations are only likely within a range much smaller than the changes encountered with North daylight. Rated life of the incandescent filament lamps is 1,000 hours and of the fluorescent lamps considerably longer.

Siemens' colour matching unit

Stationary Field Magnetic Instrument Clutch

AT present being made in a standard range of five sizes these new versatile miniature clutches made by Crofts (Engineers) Ltd., Bradford, are designed to transmit torques from 4·2 to 420 oz./ins. at speeds up to 20,000 r.p.m. They can be utilised as clutch/couplings, clutch/brakes, and duplex clutches, and have wide applications in the instrument and light engineering fields.

In addition to the above there is a range of positive engagement clutches, having the same physical dimensions as the standard instrument clutch and capable of giving torques from 14 to 1,400 oz./ins. at speeds up to 20,000 r.p.m. These can be used with advantage for indicator drives, and for many applications where a non-slip drive is of importance. All these clutches feature rapid response characteristics, which emphasise their capability for high frequency instrumentation.



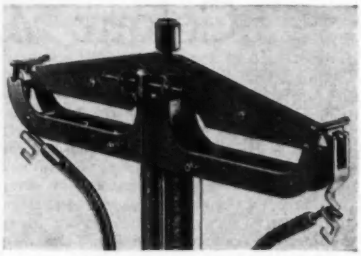
Wire Mesh Truck Eliminates Load Sagging

EMPLOYING a novel method of manufacture, Lenson Engineering Co. Churchill Road Extn.. Thurmaston, Leicester have developed a strong low-priced welded wire mesh truck. It has no sharp edges and is so made that it offers no resistance to articles being taken out. It is excellent for fabrics, bundles, and parcels and the contents are visible whilst protected. A loose fibreboard bottom is supplied, and rubbish does not accumulate, and being under 30 ins. high it can be pushed under a table or work bench. Size: 3 ft. × 2 ft. × 2 ft. deep, 3 ins. dia. rubber wheeled castors, ⅛ in. dia. top rim, and 2 ins. × 2 ins. × 10 ins. gauge weldmesh. Attractively finished in mid-blue enamel. A plastic lining can be supplied at a small extra cost for delicate fabrics.

Short Beam General Purpose Balance

THE first of the new series of balances designed for general purposes but incorporating analytical features, has been produced by Griffin and George Ltd., Ealing Road, Alperton, Wembley. The Minor balance has a short beam and the poising nuts are near the central agate, where they cannot so readily contribute to accidental displacement of the beam and are not so easily damaged. This arrangement reduces the overall length. While the balance is not in use the beam is located by two central slots in the arrestment beam and kept horizontal by two locked screws. These slots are deep enough to prevent the beam being accidentally dismounted and accurately guide the beam during assembly of the balance. The stirrups are single-piece pressed-metal type with double hook, and, when the beam is in the "rest" position, are lifted clear of the end knife-edges by the integral Y-arms of the arrestment beam.

The twin pillars which support the arrestment beam are mounted on a rectangular plate, held in position by two nuts positively located beneath the base. Between the pillars passes a plated rod which carries the central bearing plane, the scale, and the cam-plate. The use of the rectangular, slotted cam-plate, fitting directly on to the crankpin, eliminates the need for a connecting rod. The pointer, which carries an easily adjustable sensitivity weight, has an obliquely cut tip. This moves over a curved, inclined scale which rises with the beam, permitting comfortable reading without parallax. The novel form of bow adopted for the Minor ensures that loading is completely unimpeded, and an adjustable grub-screw in a lug on the base of each bow prevents the pan swinging when the balance is arrested.



The Minor balance

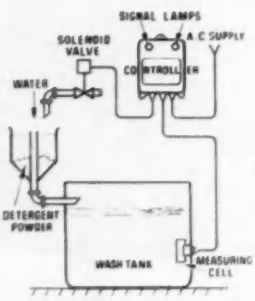
Controlling Detergent Strength in Solutions

MANUFACTURERS and operators of bottle etc. washing machinery, and similar plant, have long experienced difficulty in effectively regulating the strength of detergent in the washing solution, but Electronic Switchgear (London) Ltd., Works Road, Letchworth, have now produced a new system which automatically maintains, at a predetermined value, the concentration of detergent in wash waters. The control system is based on the continuous automatic measurement of the electrical conductivity of the washing solution. When the conductivity of the solution changes to a value equivalent to the minimum satisfactory detergent strength, a relay in the controller operates a solenoid valve which admits just sufficient fresh detergent to the solution to restore optimum concentration. Thus, the work loading of the washer determines the amount of detergent consumed, the plant economically produces a uniformly cleansed output, and the detergent manufacturer is assured of the efficient use of his product.

The diagram shows a typical arrangement of the automatic control. The detergent is contained in a small vessel provided with an overflow pipe leading to the main wash tank. When fresh detergent is required, the relay in the control unit opens a small solenoid valve which admits water to the vessel containing the detergent powder and a concentrated solution flows through the pipe to the wash tank.

A measuring cell in the main tank detects restoration of the solution concentration. A signal from the measuring cell actuates the relay in the control unit thus closing the solenoid valve until a further admission of detergent is called for. Alternatively, liquid detergent may be admitted directly to the wash tank through the solenoid valve, without the use of the mixing vessel described above.

Coloured signal lamps on the face of the controller indicate that the system is functioning correctly.



Diagrammatic representation of the automatic control system

Locker Accommodation System

A NEW idea in the provision of locker accommodation for large numbers of people has been evolved by Oostwoud Fabrieken, Utrecht, Holland. It consists of vertical steel units providing six, ten, or twelve compartments each of which can be locked, for small personal possessions, and attached alongside, hat and shoe racks and a rail on which are ingeniously arranged coat hangers. The hangers, attached to the rail by knobs which fit into a specially designed slot, always remain evenly spaced, thus ensuring that damp clothes dry out faster than they would if crowded together.

A neat point is that the hangers do not "disappear," by accident or otherwise, for the good reason that they cannot be used save in conjunction with the rail. The new Multilok locker system is said to use only half the floor space needed for conventional equipment. Further, though pilfering is not a normal hazard in most works the system does reduce the opportunities for petty thieving to a minimum because the design of the locker units and racks affords a view of all parts of a locker room.

(right) This locker system is both aesthetically acceptable and utilitarian in conception

COAL-Mechanical Stokers

and the

CLEAN AIR ACT

As recently announced in the press, a new ministerial order permits the installation of mechanical coal burning equipment in Smoke Control Areas. It follows that the most modern and efficient plant should, of course, be installed on the lines of the latest Hodgkinson boiler house equipment.

"METERFEED" UNDERFEED STOKER

This stoker has separate drive and fan motors which our "Custodian" Panel controls by cutting in the fan at a predetermined period before the drive and cutting out the fan after the drive has stopped.

The "Meterfeed" Underfeed Stoker is designed for the utmost fuel economy **without smoke** and is available in a full range of sizes in both hopper and bunker feed models and suitable for boiler, kiln and furnace application. All models embody the controlled feed principle.

NEW "CUSTODIAN" CONTROL PANEL

The combination of the "Custodian" panel with the "Meterfeed" Underfeed Stoker operates as a highly efficient guarantee against the production of smoke and its consequences under the Clean Air Act.

NEW HODGKINSON 8" UNIVERSAL COAL ELEVATOR

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★ *Many new features incorporated*
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The elevators in this range are made up from standard parts available from stock.

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Catalysts for Crease-Resistance

Many factors need consideration when selecting a catalyst. They include cost, catalytic strength, pH produced, stability, ease of conversion, time and temperature, etc.

(*Concluded from February issue, page* 74)

By J. T. MARSH

THE widespread use of metallic salts as catalysts is a post-war practice. Before discussing these catalysts in detail, it may be well to try and remove some misconceptions which exist about salts in general. There are certain "fixed" salts which are neutral in reaction and cannot act as catalysts; these may be exemplified by the salt of a strong acid with a strong base, such as sodium chloride or sodium sulphate. With the dibasic acids, however, there are fixed salts, some of which give an acid reaction in water, as sodium hydrogen sulphate for example, but this acidity does not increase and the salts may be termed "fixed acid salts." The difference between the fixed acid salt and the latent acid catalyst may be illustrated by sodium dihydrogen phosphate and ammonium dihydrogen phosphate; the latter may be regarded as an acid donor, whereas the former does not liberate further acid. However, as pointed out in B.P. 449,243, there are certain salts which liberate acid on heating by the process of hydrolysis and/or dissociation, and the most useful members of this class are formed from a strong acid and a relatively weak base. Magnesium chloride has achieved some prominence, as also has zinc chloride and zinc nitrate.

The use of magnesium chloride originated in the "promotion" of melamine-formaldehyde for crease-resisting finishes, when attention was drawn to the fact that it did not take up as much chlorine from hypochlorite solutions as did urea-formaldehyde. This has produced some remarkable repercussions and probably led to the indiscriminate use of hypochlorites, but it was soon found that there were two major disadvantages with melamine-formaldehyde, first the yellow discolouration with hypochlorite, and secondly the chemical damage when the crease-resisting goods were heated after the hypochlorite treatment, ie. chlorine-retention-damage.

Magnesium chloride was found to minimise the discolouration, and also to obviate some of the chlorine retention damage, in comparison with other catalysts. However, it is doubtful whether magnesium chloride acts as a catalyst in the orthodox sense, for it is used in very substantial amounts; one of the earliest recommendations was 18% of $MgCl_2.6\,H_2O$ expressed on the weight of the melamine-formaldehyde, and the use of 10 to 12% is common. There may be some chelation of the metal ion by the polymer, but also the basic residues exert a buffering action and so provide certain advantages in reducing the chlorine-retention-damage which would otherwise occur.

Zinc nitrate came into the picture by another route, for in Germany it was thought that the nitric acid which was produced during the reaction was almost entirely destroyed, and the basic zinc salts which remained would leave the fabric in a non-acid state and thus obviate any necessity of washing and drying the treated fabric in the works.

In certain cases, however, zinc nitrate caused a slight discolouration of white goods, so zinc chloride was used instead with the added advantage of improving the fastness to light of some direct dyes. A few finishers used mixtures of zinc nitrate and zinc chloride. The zinc salts, in some circumstances, reduce the fishy odour which might otherwise occur and this is probably due to their ability to hold the trimethylamine which would otherwise be liberated.

When metallic salt catalysts are used in the impregnating bath this is generally brought to about pH 5·5 or 6·0 by the addition of a small quantity of weak organic acid, such as acetic acid, to prevent the precipitation of metallic salts in the bath; care should also be taken where softeners and wetting agents are used in a bath containing metallic salt catalysts.

One of the chief advantages in the metal salt catalyst lies in the retention of basic residues, such as oxides and carbonates, after the curing treatment has been completed; these residues act as buffers against the acid produced by ironing the treated fabric after bleaching with hypochlorite solution. These buffers tend to be renewed or regenerated after every laundering, and although diminished on repeated washing, they are retained very tenaciously.

Metal salt catalysts are also important for chlorine retention-damage in another connection; the DMEU finish should be non-chlorine retentive but poor results were sometimes obtained, particularly after storage. This has been examined by Bacon, Smith, and Hughes (Am. Dyes. Rep., 1958, **47**, 259) working with amine hydrochloride, magnesium chloride and zinc nitrate; the last-mentioned gave optimum resistance to chlorine

damage but greatest discolouration, so that magnesium chloride was preferred. Smith (Am. Dyes. Rep., 1959, **48**, No. 8, 49) drew particular attention to deterioration on storage; he examined the effects of organic acids, ammonium salts and metal salts as catalysts, and found that the best results came from a "hard cure" with 12% magnesium chloride at 160°C., but at a temperature of 140°C. 5% of zinc nitrate was quite good. The importance of washing the treated goods immediately after curing was emphasised; this, of course, has been suggested by the inventors of the original crease-resisting process ever since it began, as has the danger of steaming or decatising before neutralising the catalyst. It may be remarked, in passing, that it is not easy to reconcile the ease of hydrolysis of the amino-aldehyde in the treated goods under mild acid conditions with the postulated existence of the co-valent cross-linkage as the sole cause of crease-recovery.

The triazone resins, because of their basic character, have a buffering action on the catalyst and prevent maximum effectiveness; there is a general tendency to use zinc nitrate, i.e. $Zn(NO_3)_2.6\ H_2O$. Reid, Frick Reinhardt and Arceneaux (Am. Dyes. Rep., 1959, **48**, No. 3, 81) have used impregnating solutions containing about 0·5% of zinc nitrate with 7·5% of the triazone; they found that increasing the amount of catalyst by 50% had no effect on the triazone finish.

The so-called "triazone resin," which is possibly a combination of melamine and ethylene urea, gave the highest recovery with zinc nitrate as catalyst, according to Cooke and Roth (Text. Res. J., 1959, **29**, 180), but the most satisfactory recovery/strength relation was obtained when magnesium chloride was used as a catalyst.

As previously mentioned, however, catalysts containing $Zn(NO_3)_2$ should not be used with those optically bleached white goods which are sensitive to nitrates.

Most crease-resisting processes employ some form of amino-aldehyde product as the main compound in the treatment but there are some other compounds under consideration, such as acetals and epoxides; these seem to need stronger catalysts probably on account of the difference in reactivity of the $—N.CH_2OH$ group compared with the $—CH_2OH$. Zinc fluoborate and mercury perchlorate have been suggested. Amine complexes of boron trifluoride have been put forward as latent catalysts for epoxy resins; the active ingredient is BF_3 which is a well-known catalyst in hydrocarbon polymerisation.

If the idea is accepted that a good latent catalyst is one which has no action in presence of water, but becomes active in its absence, or at a higher-than-room temperature, then there is much to commend the phase equilibrium catalytic system of Ryan and Taylor as described in Australian Patent 218,413 (1959) of Tootal Broadhurst Lee Co. Unlike many other salts, the concentration of magnesium dihydrogen phosphate solutions causes the separation of the monohydrogen phosphate with a rapid fall in pH; a similar effect takes place on warming to about 70°C. Hence appropriate concentrations and temperatures may be chosen to provide a most useful latent catalyst, the effectiveness of which may be increased by the addition of a suitable complexing agent, like disodium ethylenediamine tetra-acetate, enabling higher concentration to be employed in the form of complexes stable at high pH but progressively decomposing as the pH is lowered. The most convenient method of procedure is to use a suitable mixture of salts, of which sodium dihydrogen phosphate and magnesium sulphate is a good example. With an impregnating solution containing about 50% of amino-aldehyde solids, the catalyst provided was 127 c.c. of 24% $MgSO_4.7H_2O$ and 127 c.c. of 15% $NaH_2PO_4.2H_2O$ per litre. This is probably the most ingenious and effective system of latent acid catalysis ever put forward in connection with the crease-resisting process. The catalytic system is not limited to magnesium phosphate and many other examples are given in the patent specification.

General

It is clear that there are many factors to consider in the selection of a catalyst and the position is most difficult and obscure. In the absence of accurate and reliable scientific data, it is only possible to generalise on some of the main features.

Many chemists would probably agree that the present state of the art would put the commoner catalysts in the following order of "strength": zinc fluoborate, zinc nitrate, ammonium chloride, magnesium chloride, amine hydrochlorides, ammonium sulphate, and ammonium phosphate. From this general experience it is obvious that there is more in the function of the catalyst than the provision of hydrogen ions, and some workers seem to prefer the term "accelerator."

Where a mild catalysts is required, the suggestion of a mixture of the chlorides of magnesium and aluminium has been made by Irvine, Simons, and Davids (Am. Dyes. Rep., 1959, **48**, No. 12, 37).

The amounts of the various catalysts which have been suggested vary considerably but the following may be taken as typical, estimated on the solids content of the impregnating solution.

Amount of Catalyst	
Ammonium chloride	**1 — 3%**
Ammonium sulphate	**2 — 3%**
Ammonium phosphate	**3 — 5%**
Ammonium oxalate	**2 — 4%**
Magnesium chloride	**12 — 18%**
Zinc chloride	**6 — 8%**
Amine hydrochloride	**3 — 8%**

Foster (Text. Res. J., 1956, **26**, 149) has examined the effect of the concentration of the amine hydrochloride over the range of 5 to 50% on the resin solids; this corresponds to only one-third of these figures in terms of actual catalyst percentage as the amine hydrochlorides of commerce are about 35% solutions. Above 3% of DMEU on the fabric, there is no improvement in recovery with over 3% of actual catalyst expressed on the resin solids, but there was an increased loss of tensile and tearing strength. With TMM, however, there is a slight improvement in recovery as the catalyst concentration rises from 3 to 10%. An increase in catalyst concentration does not seem to offset deficiencies in time or temperature of cure; the latter has the most profound effect. In a further publication (*ibid.*, 1957, **27**, 129), Foster showed that with a constant concentration of solids, 9% in the bath, the recovery increased as the logarithm of the catalyst concentration up to a maximum of 0.3% amine hydrochloride in the impregnating bath or about 3% on the solid DMEU in the bath (Fig. 1).

However, the optimum concentration of catalyst is not the easiest of matters to decide. For example, there is the strong buffering effect of melamine and triazone compared with urea and cyclic ethylene urea, the fastness of the effect, the amount of recovery required, and the amount of embrittlement to be allowed, all of which require consideration. Again, all too many finishers use an excess of catalyst to neutralise the alkalinity of the fabric, sometimes with unfortunate results.

Cooke, Roth, Salsbury, Switlyk and van Loo (Text. Res. J., 1957, **27**, 150)

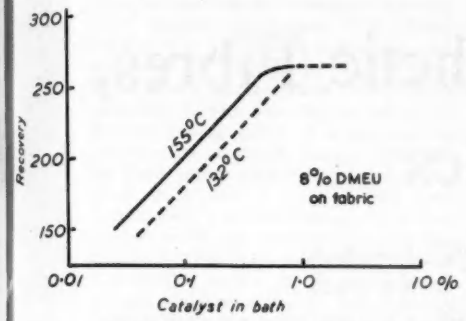

Fig. 1. The effect on crease-recovery of the amount of catalyst estimated on the impregnating bath

made an extensive study of the effect of urea-formaldehyde, melamine-formaldehyde, and ethylene-urea-formaldehyde on cotton goods where three catalysts were used, namely, an ammonium salt, an alkanolamine hydrochloride, and a metallic salt; in their view the inorganic metallic salt was the best catalyst in many respects but required a higher curing temperature. The amounts of catalyst employed in this work were those "generally found to give optimum recovery" and expressed in terms of solids content in the impregnating bath, namely 3·5% of ammonium sulphate, 7% of 2-amino-2-methylpropanol-1-hydrochloride, or 12% of magnesium chloride. No attempt was made, however, to compare their relative efficiencies or establish optimum quantities.

Frick, Kottes and Reid (Text. Res. J., 1959, **29**, 314) have compared the action of 0·5% solutions of ammonium sulphate, an alkanolamine hydrochloride, and zinc nitrate in solutions of 7% of DMEU; they found the ratio of formaldehyde to ethylene urea in the finished fabric changed with the catalyst and concluded ammonium sulphate gave a greater proportion of bound but not linked material, and zinc nitrate gave the highest amount of cross-linking, as supported by chlorine-retention data. Some chemists might perhaps cavil at conclusions drawn from the use of equal weights of substances of different molecular weights and which produce different acids.

A somewhat detailed study of the catalytic activity of fluoborates and sulphates has been made by Schroeder and Condo (Text. Res. J., 1957, **27**, 135); as one might expect from previous work on latent catalysts from organic bases, the catalytic activity depends on the strength of the basic metal, i.e. the weaker the base the better the catalytic activity. Some interesting data are given, including the pH values of various baths; it was concluded that the acidity of the bath is not the factor determining catalytic activity, but this is well-known and follows from the original work on latent acid catalysts over 25 years ago. What is of importance, is the acidity of the material at the time of cure; this may be controlled to some extent by using an appropriate indicator, such as B.D.H. 4·5, which is blue at pH 6·0, grey at pH 4·5, and orange-red at pH 3·5.

The provision of hydrogen ions is not the whole story, for the catalysts seem to display their effectiveness when the fabric is dry; furthermore, there is a temperature of about 130°C. below which no increase in time or catalyst appears to give really effective results, according to any data which have appeared. The results obtained with metal salts cannot be due solely to their function as acid-donors, where many other compounds are equally good; it may well be that the metal ion plays an important part in the reaction and that the "hard cure" is produced by combination of the divalent metal with adjacent chain molecules of cellulose and/or with the cellulose and the amino-aldehyde product to give a tighter network system.

Certain complications can occur with different catalysts and which have no bearing on the production of the crease-resisting effect itself. For example, there are some minor difficulties with regard to dyestuffs, such as change of shade or fastness properties. Catalyst *A* of Ciba, was one of the first attempts to deal with this matter by using a mixture of calcium chloride and boric acid, but the efficiency of this mixture is not very high in promoting condensation; catalyst B is probably triethanolamine hydrochloride. On the whole, the effect of the catalyst does not fall in with any known scientific pattern and from information collected by the writer (Text. Mfr., 1959, **85**, 465) the order of preference for cotton in this connection seems to be magnesium chloride, amine hydrochloride, and ammonium salts, the last-mentioned being the least satisfactory. However, it is dangerous to dogmatise, for zinc nitrate has been claimed as best with vat dyes and worst with reactive dyes; there is also the added complication of the effect on optical bleaching agents.

Altogether there are some twenty factors to be considered when selecting a catalyst, namely, cost, amount required, catalytic strength, the pH produced, the stability of the latent catalyst, the stability of the bath, ease of conversion to free acid when required, the time of heating, the temperature of heating, the compatability with other ingredients, the efficiency in promoting condensation, the recovery produced, the handle, the tensile strength, the ripping strength, the resistance to abrasion, the permanence to laundering, the dangers of discolouration, smell, chlorine absorption, chlorine-absorption-damage effect on dyestuffs, and the possible application in combined finishes, etc.

It is obvious that there is no straight and simple path through the maze of complications confronting the finisher who is seeking the "best" catalyst. Some of the published work appears to be special pleading for a particular product and does not necessarily present a complete picture. In the circumstances, therefore, most finishers would be well-advised to seek the advice and guidance of those with a long record of successful experience in these matters and to profit by their knowledge, as under the Tebelized plan. With so many different properties to keep in mind, the end-product must inevitably be a compromise; hence the problem resolves itself to achieving the best compromise and the maximum of real and lasting satisfaction to the customer.

Woollen Blankets for Hospitals

"Woollen blankets, with their warmth and comfort, their absorptive properties, low flammability, freedom from static (an important point when used in operating theatres) and the ease with which they can be made shrinkproof and disinfected with the new techniques now available, cannot be improved on for hospital as well as domestic use," reports the Wool Textile Delegation, in a press statement on the use of hospital blankets. After outlining the present state of research into various aspects of blanket use in hospitals, the delegation suggests that scientific and technical enquiries on this topic should be addressed to the International Wool Secretariat or the Wool Industries Research Association, Torridon, Headingley, Leeds. Laundries which are members of the British Launderers Research Association will get similar service from that association.

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Millions Spent on Hand Knitting

Women in the U.K. spent nearly £47 million last year in hand knitting. Deliveries of worsted knitting yarns to home market retailers during 1959 were at an all-time record level of 33,286,000 lbs. This compares with 30,188,000 lbs. in 1958 and 33,053,000 lbs. in 1957, the previous record year.

Dyeing Woollen and Synthetic Fibres, Yarns and Fabrics*

A discussion of some of the most effective and official methods for dyeing loose wool materials, and blends, tops, hanks, small and large yarn package and piece-goods

By K. LIMBERT†

WHEN dealing generally with regard to the woollen industry we see that dyeing is carried out at three alternative stages of the process. First, there is dyeing of the raw material. Present trends in fashion and the demand for patterned fancy dyeings mean that loose material dyeing predominates and again a wide variety of fibres have to be dyed. Secondly, yarn dyeing is of considerable importance but the volume is not great compared with loose material dyeing, and blends of wool with some of the man-made fibres introduce difficulties in union dyeing these blended yarns. However, woollen yarns must frequently be dyed and are dyed either in hank or package. The usual final alternative is dyeing in the piece and changing fashion has a great influence on the demand for piece-dyeing.

Although a limited number of manufacturers produce self-coloured cloths with coloured yarn from loose material dyeing, generally speaking plain coloured fabrics are piece-dyed.

The introduction of some man-made fibres has increased the difficulties of obtaining satisfactory union dyeing, but whilst many unions can be satisfactorily dyed, long process times and limited choice of dyestuff combinations have to be faced with say, wool/"Terylene" fabrics. Here we have a battle between the economic use of high temperatures on the one hand, and temperatures and conditions which will not damage wool, on the other. This limits the range of dyestuffs available, whilst matters of cross-staining and clearing and the use of carriers also arise.

In piece dyeing there arises the possibility of obtaining patterns and effects by cross-dyeing fabrics woven from yarns, each of 100% of different types of fibre, and each yarn can be coloured differently by an appropriate choice of dyestuffs.

This system is not, however, for the highest quality production where as usual the correct sequence, possibly costing more, is the best.

These considerations apply to the woollen system for coatings, dress goods and blankets and also for floor coverings. These floor coverings include traditionally woven carpets which use loose or yarn dyed material and in the newer types of construction such as tufted carpets. In this latter case, colour is obtained by dyeing loose material and subsequently spinning yarn of self or blended shades, yarn dyeing or piece dyeing either batch-wise or in special continuous processes.

Basic Considerations re-Worsted System

In considering the worsted system, in addition to the three main stages at which the fibre is coloured, there is a fourth stage. Top dyeing is the basis used for a large part of the output of these yarns. This is the equivalent stage to loose material dyeing for the woollen process and dyeing machinery is produced not only to meet the range of fibres, but also to deal with Continental type ball tops, as well as tops made on the Bradford system.

Hank dyeing is of great importance. For example, it is necessary to dye hand-knitting yarns and many high bulk yarns in an uncrushed, open, relaxed state which can only be achieved in a hank dyeing machine. In fact, a slight milling action is desirable to give the traditional fullness and handle to these yarns. The difficulties of handling the high bulk, man-made fibre yarns, as well as the demand for faster shades has required the development of special two-stick machines. This particular machine, with the Brown-Longclose double stick system (patent) has an arrangement of sticks at the top and the bottom of the machine, a feature of this system being that there is limited free movement of both sets of sticks so as to minimise the possibility of stick marks.

Package dyeing, however, is of great advantage for the most economic handling, steam and fuel saving and general efficiency. A compact smooth yarn results, giving a very clean knitting whilst excellent weaving yarns are folded up from dyed singles which would be impossible to dye in hank. Dry spun yarns are preferred for package dyeing since the oils used in the worsted system are not so easily scoured as those associated with woollen yarns, this is particularly important in the knitted outerwear trade where there is not the same final piece scouring as with woven fabrics.

The third stage is as for woollens, i.e., piece dyeing in the winch, but again the considerations of fashion greatly vary the demand. Many materials—knitted or woven—of man-made fibres are now dyed in rolled form on a beam and developing techniques may lead to a more widespread use of this type of apparatus for dyeing other woollen and worsted piece goods in roll form. A typical horizontal high temperature pressure dyeing machine for fabrics in roll form illustrates the arrangement of the pressure vessels, the external means of sampling, and addition making. The beam is entered into the pressure vessel so that liquor can be directed through the material in two alternative directions and temperatures up to and above 130°C. be used.

The fourth stage is that many actual garments made from worsted spun yarns are dyed in their final form. This covers such items as "Orlon" or fine quality wool sweaters, men's half-hose and similar garments.

Closely allied to the production of fabrics and garments which use yarn spun on the worsted system many new textured filament yarns have recently been introduced. The starting point is a continuous filament yarn of such materials as nylon and "Terylene," these being processed in such a way as to give a high degree of crimp in the individual filaments resulting in a yarn of large diameter and bulk but low specific weight. In certain cases the result of the process is to produce a regular wound package obtained by controlled winding, whilst others of these yarns are wound into a hank which subsequently relaxes on removal from the reel to form a "muff." Certain of these yarns are dyed in single ends exactly in the form produced by the crimping system and then folded into either hosiery or handknitting yarns. A further variant is that the single ends are folded up to give a resultant hand-knitting yarn which again is dyed in a hank machine.

As far as high bulk acrilic yarns are concerned, in many instances the actual bulking process is carried out in the two-stick hank dyeing machines, prior to utilising the same liquor for the remainder of the process when the colour is applied. There is now a tendency towards pre-bulking and setting yarn under controlled conditions in special steaming apparatus. In spite of the pre-setting process, it is still essential that the resultant hand-knitting yarns be dyed in a hank machine, whilst even the loftiness of bulked machine knitting yarns is lost if package dyed.

Blends of Wool and Man-Made Fibres

Certain man-made fibre blends with wool are dyed by union dyeing methods without great difficulty or complex processes by correct selection of dyestuffs. Wool/viscose blends, in the same manner as wool/cotton blends do not present particularly unusual difficulties, but where polyester fibres are used in blends with

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* *From a paper given recently to Keighley Textile Society.*

† *Longclose Engineering Co. Ltd.*

wool the most effective system undoubtedly is to dye each component of the blend separately to the correct shade and then blend the correct quantity of each fibre. Wool should not be dyed at a temperature exceeding a very few degrees above the normal boiling point of water, and to preserve its condition should preferably be dyed under slightly acid conditions. With good control of pH, time and temperature, the total damage in a short process using high temperature techniques can be less than the damage associated with considerably longer process times at the normal temperature range, that is, a few degrees below the boiling point of water. On the other hand, the polyester fibre is most effectively dyed with either dispersed colours or by the modified azoic technique at temperatures regularly in the order of 120°C./130°C. In order to use low temperatures, a very limited range of dyestuffs is available and in most cases excessive time and the use of carriers is required.

The various considerations regarding the form in which the material is to be dyed either for the woollen or worsted system, lead us to the development of universal machines in which loose material, tops either as balls or reeled hanks of slubbing, or bump tops, cheeses or cones of spun yarns, or special packages of textured filament yarns are dyed. Today, these universal types are available in a range of sizes and of varying degrees of simplicity so that the right type of machine for the simplest and most economic operation can be specified for particular requirements. A new range of "easy-to-work" machines are available, particularly for dealing with slubbing or loose material and in a variety of forms to deal with different temperature ranges.

Loose Material

Machines for loose material are usually associated with the woollen industry, although in certain instances investigations are being made into dyeing loose staple fibre subsequently to be carded and combed for onward use in the worsted system. This loose material dyeing is in fact being carried out in the U.S. by some firms.

In order to deal with wool in its many forms, the most economical machine is that operated by a low pressure propeller. In the Longclose enclosed pear shaped loose wool dyeing machines, the material is loaded on to a perforated false bottom and held between this and an adjustable perforated top grid and the liquor circulated vertically upwards or downwards by means of a propeller which is situated in the narrow end of the pear. A feature of this machine is that as the weight of wool is reduced, and the top grid lowered, so the height of the partition plate is lowered permitting a reduced quantity of water to maintain as near as possible a similar liquor ratio and a saving in steam consumption.

Many types of loose materials, however, require an increased pressure in order to obtain adequate circulation and penetration of the liquor. This introduces the need for pumps, pressure pipelines and valves, and a typical example is the conical pan loose material machine. A further varient of pressure dyeing machinery for loose material is in connection with the universal pressure machines and in which a cylindrical pack dyeing cage replaces the frames for dyeing tops or yarn.

Tops

The equivalent stage to loose material dyeing as far as the worsted industry is concerned is top dyeing. The first type of machine considered is the can type machine. This has a number of cans varying between 1 and 40 according to batch weight, and with the Bradford system each can accommodates two typical ball tops. Alternatively, where drying facilities necessitate it, the balls can be reeled into hank and a similar weight of slubbing loaded in each can. A second range of machines with the same number of cans is produced but with a slightly shallower can of greater diameter, each can accommodating one of the larger Continental type ball tops. Again, an equivalent weight of slubbing in reeled hanks can be loaded in each can as an alternative to the balls.

A recent development particularly associated with pressure dyeing machines is the system of dyeing balls mounted on stainless steel perforated spindles and surrounded on the outside by a cylindrical perforated stainless steel cage. Circular frames of this type with a number of spindles and outer cages, are accommodated conveniently in a universal pressure dyeing machine as an alternative to a loose material pack dyeing cage or package dyeing frames. These radial flow ball top dyeing frames may be used in full high temperature machines so that temperatures up to and above 130°C. can be applied to such fibres as "Terylene."

Alternative styles of frames are available to deal with Bradford type or Continental type tops. An important feature of one frame (illustrated by the speaker) is the quick-acting follow-down, locking system on each of the spindles. This is important so that loading is speeded up by means of a press lever without the use of screws and, furthermore, as the material wets out and consolidates, so the hood above each column of material can follow the contraction of the material and thus prevent channelling with resultant felting of the ends of the tops.

Hank Dyeing

Hank dyeing machines, widely used for worsted hosiery, worsted hand-knitting and man-made fibre yarns, are equally important in the carpet industry where large weights of yarn in hank are dealt with. To remove oil, dirt and impurities, hank scouring is extremely efficient and this is followed by loading the hanks into the large carpet yarn dyeing machines. The demand during the post-war years has been for greater weights to a shade and one machine will dye up to 9 000 lbs. of carpet yarn at one time to one shade.

To achieve the greatest loading for a given area of machine we have developed a staggered arrangement of the dyesticks. This system minimises the amount of metal of the dyesticks at one level in the machine and prevents congestion at the point at the head of the hank and the dyestick. A further development in these machines is the use of a split frame system which enables the yarn to be loaded on the dyesticks at waist height in the horse, the sticks never subsequently having to be lifted manually into a frame raised above a normal man's height. After the frame has been loaded with the sticks and yarn the whole unit is locked together and lifted bodily to the dyeing machine. After dyeing, when the yarn is in a much heavier wet state the reverse procedure applies with even greater saving in manpower.

Package Dyeing

Package dyeing of woollen or synthetic yarns tend to give even greater advantages than hank dyeing since the packages can be wound and stored compactly, and subsequently loaded, scoured and dyed all in the wet state, followed by drying. Hosiery yarns dyed in package form give a very clean appearance to the pattern of the knitting, but package dyeing is not a satisfactory answer for hand-knitting yarns or high bulk acrilic yarns. For knitting it is essential that the package be re-wound into the required form, and again cheeses are usually adopted in the woollen industry. The requisites for successful package dyeing include:—

(1) Correct winding to ensure even density inside to outside of the package. Even open cross-wound wind along the length of the traverse and the avoidance of sharp corners.
(2) Clean water and clean conditions are required in the dyehouse since packages are excellent filters and no impurities or solid matter must be allowed to contaminate the liquor.
(3) Although excellent scouring of woollen yarns is achieved, somewhat greater difficulty is encountered with the oils associated with worsted yarn and for the knitted outerwear.

Piece Dyeing

A typical modern all stainless steel piece dyeing machine has a stainless steel hood with windows of armour-plate of large area. A special feature in this machine is the open winch having lags of rectangular section stainless steel tube with large bearing surfaces and a matt finish to impart excellent grip to the pieces. This machine is provided with a comprehensive process control panel and safety devices include an interlock between the valve in the steam chimney with the front doors so that the doors cannot be raised and a rush of steam injure the operative.

Paddle Dyeing

The final stage in dyeing techniques applied to garments is in the final garments themselves, and considerable quantities of knitted ladies' outerwear, half hose and similar types of garments are dyed usually today for these types of goods in an overhead paddle machine.

To achieve maximum batch weights, many of the types of machines described are coupled in a similar manner to the coupling of hank dyeing machines. This system allows the maximum weight to be dyed to one shade at one time, whilst the machines can be isolated completely from each other by means of a double valve system, so that each can be used for carrying out a separate dyeing.

Some thirty years ago stainless steel became available commercially and we immediately took up this new metal. With the passage of time greatly increased thicknesses of stainless steel were used followed by reinforcing the machine in stainless steel only. This has resulted in machines in which the whole structure of the dyeing unit is in stainless steel. This is not only for external cleanliness but to ensure the maximum life since stainless steel has a very high co-efficient of expansion and the regular heating and cooling of the machine must be allowed for, so that the whole vessel can breath without

distortion or flexing. Again, vibration must be reduced to a minimum so that physical properties of the metal are not altered with resultant cracking.

One of the main aids to removing vibration on the dyeing machines is the use of closed coil heating. This really is a secondary consideration since the use of closed steam coils is much more efficient from the fuel efficiency point of view. Closed coils give increased fuel economy, great cleanliness since there is no possibility of dirt coming in from the boiler or from the steam range. Again, there is no change in the liquor contents of the machine, this being a further aid to economy and also to the establishment of accurate recipes and avoidance of waste of dyestuff and chemicals. Bubbles of live steam cannot come into contact with delicate materials. The heating is silent. A further economy is that a supply of hot condensed water is produced either for boiler feed or for general dyehouse purposes. A further advantage of closed coils is that cold water can be circulated alternatively for cooling where this is desirable at normal temperatures and, in any case, to increase the overall efficiency of operation after a run at a temperature well above the boil in a pressure machine.

The main aim of the dyeing machine manufacturer is to streamline the units for ease of operation. A typical example is the provision of quick-acting pressure covers on pressure dyeing machines. A further example is the follow-down quick-acting locking system for the top dyeing frame. The covers of pressure vessels which are of considerable weight, are accurately counterbalanced to prevent strain on the operatives and accidents and make the running of the machine much more smooth. In the overall design of pressure dyeing machines it is essential that the sampling units, addition units and control points are grouped in the most convenient manner.

The rate of production has been increased by careful designing. A most important step in this direction was the introduction of high temperature techniques. The use of high temperatures gives increased flow due to lower viscosity of the liquor, the pumps are not subject to cavitation and loss of efficiency near the boil. There is greater permeability of the liquor through the packages and the increased temperature promotes migration and an increased rate of penetration.

Automatic Controls

Whilst it is impossible to eliminate the craftsmanship and skill required during dyeing operations, it is most important that full note be taken of the recommended chemicals and assistants to be used and the correct control of times, temperatures, pH of liquor, reversal of flow, etc. Automation can be carried to the greatest limits as one realises the amazing developments in space exploration but there are limits beyond which the elaboration of automation in a dyehouse defeats its own ends. Automatic control instruments are of necessity delicate scientific equipment, whilst the conditions even in the most modern dyehouses are anything but ideal for the preservation of the good working order of the instruments.

Simplicity is therefore the keynote and the aim of dyeing machine manufacturers and the instrumentation industry is to provide robust instruments to remove from human error the main features in a dyeing process. The instruments should therefore be reliable, simple in setting and operation, designed to give control of the basic factors and yet permit flexibility so that conditions for subsequent runs of a dyeing can be adjusted as required.

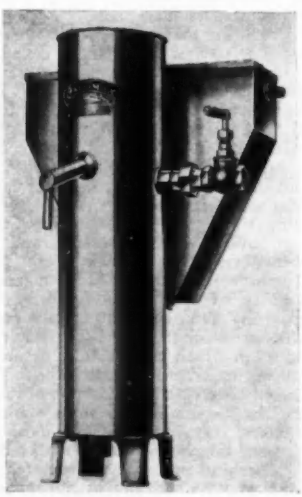
Construction for Woven Nylon Overall Fabrics

NYLON overalls, used in many industries, are expected to withstand severe conditions of wear, and B.N.S. are often asked for guidance on appropriate fabric constructions. In an advance report, it is pointed out that continuous filament yarn, 205 den., is commonly used as warp and weft for overalls. The high yarn and filament denier ensures a fabric with body and cover adequate for an outer garment and one that will withstand the stress and abrasion of work-wear. Suitable constructions in 205 den. yarns fall into two groups: square fabrics and warp-predominant fabrics.

As avoidance of seam slippage is one of the most important considerations in the construction of a successful overall fabric, a minimum seam strength of 40 lbs. is considered necessary. A square fabric with a loomstate construction of about 56 × 58, finishing at about 60 × 60, tends to have the better resistance to seam slippage: but warp predominant fabrics, with a loomstate construction of about 68 × 54 and finishing at about 72 × 58, yield better coverage and appearance (some constructions below the latter figure will give satisfactory performance, but any significant reduction in pick rating is likely to result in slippage of the warp over weft and unsatisfactory seam performance in wear).

The most satisfactory overall fabrics from 205 den. yarn have 5 t.p.i. in both warp and weft. To save cost, flat (unthrown) yarn is sometimes used in warp but is not recommended: preparation and weaving are somewhat more difficult, and there is a risk of more warp faults in the fabric. Flat weft yarn is not recommended because of the possibility of package barré in the weft.

The effect of the use of flat yarns on apparent wear life is at present being investigated. It is known that flat yarns are more readily susceptible to snagging and filamentation, and, under certain conditions of wear, fabrics made from such yarns may prove unsatisfactory. Other qualities desirable in the finished cloth are low shrinkage in hot water (less than 2% in any direction), and good colour fastness to washing, perspiration and rubbing.



Improved Steam-Operated Water Boilers

TO meet the call for low pressure steam operation, an entirely new range of boilers in various sizes and outputs has been made available by Calomax (Engineers) Ltd., Brunswick Terrace, Leeds 2, to operate on pressures as low as 5 to 40 p.s.i. with outputs of 5 to 20 pints/min., and claimed to be comparable to the maximum outputs previously obtainable from boilers with higher steam pressures. Of special interest is the new Q.R.10 model introduced for works which operate on exhaust steam, or institutions on restricted steam pressures. In addition, the improved new models, when operating on medium steam pressures, produce up to 32 pints/min. if required; this is said to represent an output increase of approximately 50% over previous models of a similar physical size. An interesting constructional feature of the Calomax boilers is the breather arrangement which prevents free circulation of steam vapour in confined areas, and consequential damage to structural surroundings and decorations. Excessive humidity is therefore prevented.

Scouring and Bleaching Raw Stock, Yarn and Fabrics

Only the basic methods are discussed in this article with some attempt made to emphasise the salient points and precautions necessary to avoid difficulties

By K. S. CAMPBELL*

COTTON may be scoured in most of the physical forms in which it is handled from raw stock to woven fabric. Raw stock is usually scoured in a cylindrical tank or kier, preferably stainless steel, capable of holding approximately 1,000 to 3,000 lbs. (2 to 6 bales) of cotton. These machines may be open, in which case a temperature of 200°F. is about maximum, or closed, when temperatures of 240 to 250°F. can be attained. Liquor is usually circulated by centrifugal pumps in one direction only, top to bottom. Because a certain amount of channeling is almost certain to occur as the circulating liquor seeks the paths of least resistance, blending of stock after processing is essential.

The scouring formula for stock to be dyed will usually be just enough to remove enough surface waxes and readily soluble pectins and ash to make the fibres easily wettable with the hot dye liquor. A 30 mins. scour at 190 to 200°F. with 2% soda ash owf., plus a small percentage of a synthetic detergent, followed by thorough rinsing, will often be satisfactory. For cotton that is to be bleached, a more severe treatment is required. Formulas will include 4% caustic and a small amount of wetting agent or detergent, and the goods will be scoured at 190 to 200°F. for from 1 to 4 hours. For bleached absorbent cotton, a 4-hour boil in 5% caustic plus 1½% owf. detergent at 240°F. is necessary.

Methods for Scouring Yarn

Cotton skeins, weighing 1 lb. or more apiece, are processed in a variety of equipment. Tubs and several makes of machines with varying capacities of from 10 to 500 lbs. or more are used. The machines permit movement of the skeins in the treating liquor or the liquor through the skeins in various ways so as to achieve uniform results. Occasionally, skeins are processed in kiers. In addition to skeins, yarn is processed in the form of a continuous rope or warp and also in 1- to 2-lb. packages of yarn wound spirally upon perforated or spiral-spring cores.

The formula for scouring yarn in any of these forms depends upon the quality of the cotton in the yarn and the particular process to follow. A simple scour, used for long-chain rope warps in indigo dyeing, consists of a short passage (about 18 secs.) in soda ash at about 200°F., followed by rinsing.

If warps are handled in "short chain" (i.e., doubled enough times to make the resulting length somewhere between 250 and 300 yds.), then the equipment used for processing may be a single box fitted with squeeze rolls ("Scotch tub") or a series of such boxes at the end of which is a plaiter to pile the warp on movable platforms.

Passage of the warp through this equipment is repeated enough times to accomplish the boil-out, dyeing, and final wash. The severity of the initial boil-off is determined by the type of yarn and the dye to be applied. Some yarn in packages or beams does not require much more than a wetting out with alkali or penetrant before dyeing, particularly if the yarn is soft and coarse and the dye used is one that has good leveling properties.

Such a wetting out may be accomplished in 15 to 30 mins. at 200°F. With higher-quality yarns, rinsing after this scour may not be necessary except for cooling purposes prior to dyeing at low temperatures, as with vat or naphthol colours. With low-quality cotton, the brownish-yellow colour of the solution might interfere with the bleaching or dyeing; so rinsing is required. This rinsing usually need not be complete enough to remove all the detergent, however, as these agents are frequently useful assistants in the dyebath.

Yarn mercerisation prior to scouring removes some of the natural impurities (including colour) and thereby helps to reduce the severity of the scour needed. However, because packages and beams of yarn are very effective filters and will strain out insoluble matter that may interfere with the free running of yarn in later processes, the need for cleansing should not be underestimated; experience will be needed to show when it can be safely neglected. In those yarns where elimination of a preliminary scour has been established as safe, it has been found advantageous in the pigment method of vat dyeing to circulate the pigment dispersion directly into dry yarn. Dye distribution takes place more easily in cotton that has not had an opportunity to swell.

With some types of yarns, notably those spun from irrigated cottons that may contain unusual amounts of insoluble polyvalent metal compounds, a hot acetic-acid rinse will counteract the tendency of such impurities to reduce dye yield and fastness. The normal loss in yarn weight due to scouring is 5 to 6% (this loss is ordinarily made up for at least in part by the addition of softener in the last rinse after dyeing or bleaching). All the natural waxes should not be removed from the cotton because over-scouring may produce a harsh yarn which could give trouble in subsequent processing and fabricating.

Preparation of Piece Goods

After the quench following desizing, cotton fabric is handled either in rope or open-width form. Rope form permits faster cloth speeds and simpler equipment; but goods that are relatively heavy or tightly woven or those sensitive to surface abrasion cannot be processed in this manner because crease marks, rub marks, and crow's feet will show up in the fabric after dyeing. As a rough guide, fabric heavier than 2 yds./lb. requires open-width treatment.

Piece goods that are bleached and sold as white or that are to be printed must be given a comparatively severe boil-off. A good bottom is necessary to produce a good white and also to permit rapid absorption and subsequent fixation of print colour. In batch processing in kiers, a typical formula calls for 3·0% caustic soda, 0·25% detergent, and 0·25% tetrasodium pyrophosphate (all based on the weight of the goods).

Usual procedure calls for heating the kier to 205 to 210°F. over a 2-hour period, treating at this temperature for 1 hour with the kier open to eliminate any air, then closing the kier, raising the pressure to 15 lbs. (250°F.) over a 2-hour period, and holding for 3 to 5 additional hours. Thus the total time required, including about 30 mins. for rinsing free of caustic as a final step, may be up to 13½ hours; for some types of goods, the process may be repeated.

Care with Coloured Yarns

Because the products of hydrolysis of any residual starch and other impurities associated with cellulose have a reducing action on colour, fabrics containing coloured yarns may be scoured by a batch process only under mild conditions that do not reduce the dyes present. A pressure kier boil is generally not used, and the treatment is usually carried out below a boil with 1 to 2% soda ash as the alkali plus detergent and a mild oxidising agent such as sodium nitrobenzenesulphonate as a protective agent, the latter being preferentially reduced instead of the dye. For some goods, the alkaline scour is dispensed with entirely because a single or repeated bleach may produce sufficient whiteness to meet requirements. Cotton knitted goods are ordinarily not scoured before bleaching. The knitting yarns have never been sized and are usually fairly clean, and the whole structure is easily accessible to the treating liquors. A combination scour-bleach using alkaline hydrogen peroxide is quite satisfactory.

Woven fabrics too heavy to be processed in rope form or for small lots that do not

* *Dept. of Textile Chemistry, N.C. State College School of Textiles, U.S.A.*

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justify the use of a kier or a continuous range can be scoured on a jig. The minimum volume of water is used with 4 to 6% caustic and about 0·5% of a compatible wetting agent. The cloth is run for four to six ends (or about 1 hour) at 180 to 200°F. A running rinse is used to remove the caustic. At no time in processing should caustic-saturated goods be allowed to dry out, as this will cause concentration of the caustic in the dried-out areas that show up after dyeing as dark streaks and spots.

Where Progressive Jigs Fit In

For the preparation of fairly large quantities of relatively heavy goods, the progressive jig is used. This unit consists of a long rectangular box in which are mounted a series of beams or rubber-covered rolls that will carry 2,000 to 3,000 yds. of cloth. The lower halves of these beams are immersed at all times in a 6% solution of caustic maintained as close as possible to the boil. The goods are wound from one beam to another and require 3 to 4 hours to move through the machine.

The production of the progressive jig is in a sense continuous, as cloth is almost constantly being fed in one end and taken out the other. Becks are sometimes used to process woven cotton material; any or all wet treatments from desizing through dyeing may be performed on these machines. Becks can be set up to handle goods in rope form or open width as necessary. In general, the scouring formulas are about the same as those used on the jig; but treatment is somewhat milder because the liquor-to-goods ratio in the beck is approximately 20 to 1, whereas in the jig it is nearer 3 to 1.

Continuous Systems

There are three methods by which cotton fabric may be scoured continuously. The essential principle in all three is the exposure of cloth impregnated with 3 to 4% owg. caustic soda to saturated steam at close to 212°F. for a period of 30 mins. to 1 hour. The difference in the three systems are mechanical.

In the Mathieson system, goods are handled open width on an enclosed endless stainless-steel conveyor in an atmosphere of steam. The du Pont system utilises insulated J-boxes preceded by a heater tube that serves to delay the cloth in passage while maintaining a steam atmosphere and a cloth temperature of 210 to 212°F. J-box capacities in standard systems range from 2,500 to 5,000 lbs. of cloth, and the goods remain in the J-box for about 1 hour. In the Becco type, steam is introduced directly into the J-box to heat the cloth; and the box is open at the top, sealed only by the cloth itself.

In all three systems, the steaming operation is preceded by some type of saturator and followed by a continuous washer, either tight-strand rope, slack-loop, rope or open width. The efficiency of the washer really determines the permissible top speed of the range. As has already been mentioned, mercerisation alone accomplishes a certain amount of scouring. The 20 to 25% caustic-soda solution that is used to mercerise cotton, even though cold, coupled with the usual squeezes and hot-water washing, sometimes removes enough of the foreign matter so that the goods may be taken directly to the bleach. This effect is especially useful with goods that contain mostly, or entirely, coloured yarns. In such cases the bleach serves to complete the scour and brighten the colours.

Kinetics of Dyeing Wool with 1 : 2 Metal Complex Dyes*

SINCE its introduction in 1949 the class of 1 : 2 metal complex dyestuffs for the neutral dyeing of wool has grown very rapidly. These metal complex dyes are anionic dyes like other acid wool dyes, although they contain no sulphonic or similar ionising groups. Most of the research work done on them has dealt with the effect of the chemical structure of the dye anion on the neutral drawing property; the effect of cations in the dyeing of wool has had little attention.

This paper shows that in the neutral dyeing of wool the various cations have a pronounced effect on the rate of exhaustion, similar to that observed in the direct dyeing of cellulose. The effect of cations on the equilibrium exhaustion was not investigated, but there does appear to be a relationship between the rate of dyeing and affinity.

To explain the influence of cations it was assumed that the rate of dyeing is largely determined by the adsorption of dye at the fibre surface and that this adsorption equilibrium is affected by the same general thermodynamic principles as the distribution of such dyes between water and an organic solvent.

The effect of cations on the distribution of anionic dyes between water and solvent was demonstrated in a few simple experiments. Increasing the concentration of the cations in the water phase and increasing their affinity for the solvent produce an increased absorption of dye anion by the solvent.

The same effects are found in the kinetic investigation: lowering the pH values increases the rate of dyeing because of the higher concentration of hydrogen ions. The effect is similar for all the dyestuffs investigated, and similar to what would be expected for the distribution of these dyes between water and an organic solvent provided that only hydrogen ions can act as gegenions. This suggests that even in the neutral dyeing of wool hydrogen ions are the preferred cations, probably because of their high affinity for the basic groups in wool.

Sodium ions can act as gegenions when their concentration is high enough. The rate of exhaustion is therefore increased by adding sodium chloride or other sodium salts, but generally concentrations of more than 10^{-3} moles per litre are necessary.

In some cases the addition of salt decreases the rate of dyeing, as is shown for Irgalan Brown Violet DL. The formation of large aggregations, confirmed by measuring the diffusion of the dye through a porous plate under the condition of dyeing, easily explains this behaviour.

Cations of high affinity for the fibre, e.g. some quaternary ammonium cations, or cationic dyes, increase the rate of dyeing even when present in small amounts.

It was found that calcium and magnesium ions have good affinity for wool in the isoelectric region and therefore increase the rate of exhaustion appreciably. Concentrations of the same order produced by the hardness of water are sufficient. Moreover, calcium and magnesium ions present to some extent in wool may have a similar effect. Under certain conditions in hard water not only is the rate of dyeing increased but skittery dyeings with poor penetration are produced.

The kinetic investigations were carried out by means of a specially constructed dyeometer with efficient circulation and precise temperature control. Normally the results can be satisfactorily reproduced. The main source of trouble is the adsorption of many of the dyes at the surface of the dyeing apparatus, especially at lower pH values.

Tests were carried out in an attempt to interpret the exhaustion/time curves in terms of some known diffusion equations. In many instances it was found that the rate of dyeing is proportional to concentration in the dyebath, and thus when the logarithmic value of the dye concentration is plotted against time the result is a straight line. This suggests that diffusion through a thin surface membrane —the epi or endocuticle—is the factor that determines the rate of exhaustion.

The view that dyeing proceeds in two distinct stages is confirmed and the effect of pH, temperature and concentration on the first step, the initial adsorption or strike, is demonstrated.

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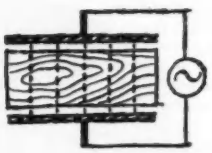
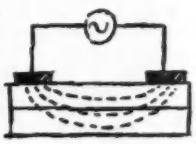
* *Summary of a recent paper by Dr. H. Ackermann (J. R. Geigy S.A., Basle, Switzerland) to the West Riding Section of the Society of Dyers and Colourists, Bradford.*

Dielectric Heating - 1

When an electrically non-conducting material is placed between two metal plates, called electrodes, connected to an A.C. supply, the alternating electrostatic field between the electrodes considerably speeds up the molecular movements in the material (termed a 'dielectric') as a result of which the temperature of the material under treatment rises. A similar effect is produced where the two electrodes are positioned on the same side of the dielectric; in this case the electrostatic field between them is generally known as a 'stray' or 'fringe' field.



For industrial application, the applied voltage of the order of 15,000 volts supplied by an electronic generator alternates at frequencies of some millions of cycles per second.



The amount of heat generated in the dielectric is determined by the frequency, the square of the applied voltage, the dimensions of the object and a physical property of the material termed "loss factor" and is represented by the equation:—

$$\text{Power} = 1.41\ E^2\ f.\ F\ \frac{A}{t} \times 10^{-15} \text{ kilowatts.}$$

Where E = applied voltage, f = frequency, F = loss factor.

A = area of the dielectric in square inches.

t = thickness of the dielectric in inches.

F, the loss factor, is itself equal to the expression K Cos Ø in which:

K = the dielectric constant, a measure of the property of the material to retain energy arising from disturbance of its molecular structure.

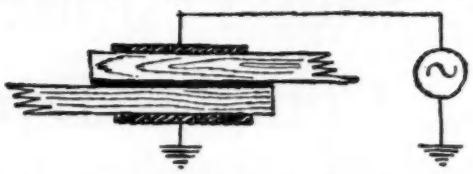
Cos Ø = the dielectric power factor of the load, that is the ratio of the power (in watts) to the product (in volt-amperes) of the voltage and current. This is a characteristic property of the material.

Therefore, "loss factor" is a property of the material and a measure of the ease with which it can be heated by this method. Like other physical properties, it varies considerably for different substances. The equation shows that the heat generated in a dielectric is proportional to its loss factor, but the rate of rise of temperature will also depend upon its specific heat and density. The following table gives approximate values of the dielectric constant, power factor and loss factor of a few typical dielectric materials for frequencies around a million cycles a second.

MATERIAL	DIELECTRIC CONSTANT	POWER FACTOR	LOSS FACTOR
Natural Rubber	2.9	0.02	0.058
Oak, dry	3.3	0.04	0.132
P.V.C.	5.3	0.06	0.318
Urea formaldehyde	7.0	0.03	0.21
'Bakelite' resin	6.0	0.03	0.18
Nylon	3.7	0.05	0.185
Water, pure	80.0	0.03	2.40
Water, tap	80.0	0.5/5.0	40/400

The high loss factor of water means that materials which are difficult to heat when completely dry will often heat efficiently when moisture is present. The voltage must be increased towards the end of the process in some cases to remove the final moisture traces, the reduction in loss factor as the material dries out providing a safeguard against overheating.

Dielectric heating of a homogeneous material is a straightforward application, heat being generated uniformly throughout. If the workpiece is made up of a number of materials, each material will heat up uniformly but each at a rate depending upon its loss factor, thermal properties and density. The degree of temperature uniformity throughout the workpiece will then depend upon the extent to which thermal conductivity can equalise different rates of heating.



Such different rates of heating can be turned to good account in certain applications. For example, in wood glue setting, the glue lines heat up much more rapidly than the wood pieces being joined and the glue sets before the wood heats up substantially, wood having a lower loss factor than glue. Dielectric heating does not depend upon any external heat source to transfer heat by conduction, convection or radiation to the surface of the charge and from thence to the interior by conduction.

Instead, heat is generated within every particle of a body placed in the dielectric field and, depending upon the uniformity of such a body, an even and extremely fast temperature rise can be achieved.

For further information get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London, W.C.2. Telephone: TEMple Bar 9434.

Excellent reference books on electricity and productivity (8/6 each, or 9/- post free) are available—"Induction and Dielectric Heating" is an example.

E.D.A. also have available on free loan in the United Kingdom a series of films on the industrial uses of electricity. Ask for a catalogue.

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New Books

FILMDRUCK (SCREEN PRINTING). By Richard Künzl. Two manuals. Text volume, 84 pages. Picture volume, 75 pages. Robert Kohlhammer Verlag, Stuttgart. 1959. Both volumes: DM 18.90.

To his standard book "Der Filmdruck auf Textilien" (Screen Printing on Textiles) published in 1953, the author has now added two further but smaller books on the same subject. It gives the reader and textile printer an up-to-date survey of recent developments in this more expanding branch of textile printing. The text volume describes the methods of making screens, for producing the pattern itself on the screen, and the photo-mechanical preparation of screens, a method which has gained more and more in importance, as up-to-now no other method shows up the same detail of the design.

Described in great detail it is all based on the long practical experience of the author. The second or complementary volume shows illustrations for designing patterns and for screen making; there are also pictures of ancillary equipment and of the recently developed automatic screen printing machines. The illustrations are all numbered and one has to look for the corresponding number in the text book to find out the meaning of the illustrations; it would have been helpful to add a list of the illustrations in the picture volume and to print separate captions to each picture. Both volumes are well produced. Apart from Künzel's excellent books there is the well-known book by W. Tausssig "Screen Printing" (Clayton Aniline) which was published in 1950; in view of the many new developments in screen printing technique an English book on the subject, combining the experience of both authors, would be welcomed.

B.S.

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BRITISH INDUSTRIALISTS, STEEL AND HOSIERY, 1850-1950. Charlotte Erickson. Cambridge University Press, Bentley House, 200 Euston Road, London, N.W.1. (price 40s.).

This excellent study embodies the results of work done under the auspices of the National Institute of Economic and Social Research. It owes much, so far as source material is concerned, to business histories issued by industrial and commercial undertakings and to local records, all used by Dr. Erickson with an imaginative eye to significant events, facts and personalities. The hosiery industry, highly localised, specialises in a comparatively narrow range of processes for the manufacture of consumer goods carried out in relatively small establishments. The steel industry, on the other hand, engages in large-scale production of capital goods and is far more highly integrated. Both experienced major changes in production methods and organisation during the latter half of the nineteenth century.

The work is mainly an analysis of the lives of roughly a thousand persons who have been leaders in the two industries over the past 100 years. Chapter 1 sets out briefly the qualifications needed for inclusion in the study; states the main sources of information used; and shows what proportion of the whole "populations" are given in the samples. Four further chapters give the principal findings on social origins and career patterns and describe the changes during the period. Chapters 6 and 7 discuss firms and individuals who introduced innovations in the early years and a final chapter studies the influence of the public company on management recruitment and training. Ten appendices and numerous tables give necessary statistical illustration and explanatory material on the results achieved by the author. The volume is fully documented and ably indexed.

S.P.S.

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CARPET ANNUAL, 1959-60. British-Continental Trade Press Ltd., 222 Strand, London, W.C.2 (price 20s.).

Quite one of the most interesting features of this 500-page volume is an article entitled "The Future of Tufting," by William H. Wise, European consultant of Bigelow-Sanford Carpet Co., in which a nice balance is maintained between his reminiscences of the early days of tufting in the United States and his forecasts of future developments. As usual in this directory, prominence is rightly given to the design review of the year, which contains 285 illustrations, many of them in full colour, of outstanding patterns and design trends. Technical developments are reviewed by experts and statistical reports of the production and sales in fourteen countries are given in the World Survey. A special chapter covers the Oriental carpet trade. The reference section includes a world directory of carpet manufacturers, wholesalers and importers as well as suppliers of materials and equipment needed by carpet makers and distributors, and a Who's Who contains the names and company allegiance of some 3,000 carpet trade personalities. Carpet trade names and the related suppliers are also listed.

S.P.S.

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QUALITY CONTROL. Norbert L. Enrick. Third edition. The Industrial Press, New York, and Machinery Publishing Co., National House, West Street, Brighton, Sussex. 1959. (pp. 184.)

This is a manual of quality control procedure, based upon scientific principles and simplified for practical application in various types of manufacturing plants. The author, a consultant and Fellow of the American Society for Quality Control, aims at simplified presentation, from a practical viewpoint, of the principles and application of modern quality control in industrial plants. He describes in 18 chapters the fundamentals of inspection, procedure in installing lot-by-lot inspection, applying quality control in the plant, statistical basis of modern quality control, and related subjects. At the end is a list of technical terms and their equivalents, and a subject index.

Case histories and practical samples have been taken from the author's consulting and installation work in the metal-working, chemical and textile industries. With the increasing interest and demand for quality control and high standards of inspection, the book is of considerable value to all concerned with this aspect of modern industry. Some of the case histories have their counterparts in the textile industry. The book also offers students a much better understanding of this absorbing study of means to higher efficiencies.

B.S.

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DIRECTORY OF OPPORTUNITIES FOR QUALIFIED MEN, 1960. Cornmarket Press Ltd., 1 Lower James Street, London, W.1 (price 8s. 6d.).

Mechanical engineers, chemists, electrical engineers and accountants, in that order, lead the table of categories of qualified people most in demand, according to this latest edition of the directory, in which approximately 100 companies outline their recruitment requirements and the career prospects they offer. The directory provides a clear and detailed picture of openings available to newly qualified men and women. Articles give forecasts of the demand for executives abroad and a series of graphs shows how the demand for executives has grown during the past twelve months. In order that qualified persons should have a wider view of their work and be kept up-to-date in it many short, full-time courses have been arranged for 1960. Details of those so far as available, are listed. The reference section sets out in detail information about commercial and industrial organisations and Government departments and the classified index summarises in tabular form further facts about the size of the organisations, whether men and/or women are employed, and the areas in which employment is offered. Another index refers people with particular qualifications to the organisations wishing to recruit them.

C.L.W.

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WORK STUDY. R. M. Currie. Sir Isaac Pitman and Sons Ltd., Pitman House, Parker Street, London, W.C.2 (price 22s. 6d.).

It is most appropriate that this work should come from the pen of one who is president of the Work Study Society and also head of the Central Work Study Department of I.C.I. Ltd., which now employs some 1,500 persons in work study. The book is also timely, as several professional and educational organisations now offer qualification in work study by examination and the need for such a basic text book has thus been emphasised. First of all, Mr. Currie shows how work study has developed from the days of Robert Owen, Jean Perronet and Charles Babbage to the present time. Such an historical approach is essential to proper appreciation of the purposes, functions and benefits of work study correctly applied. It is good to note that, although the author describes work study as being essentially a ruthlessly analytical and inquisitive approach to the use of manpower, materials and equipment, he obviously attaches great importance to the human factor, devotes a chapter to the human context of work study and also makes many references to operatives' reactions to the impact of work study. The greater part of the book is taken up by thorough and detailed treatment of the various techniques of work study, illustrated by many charts and diagrams, and ends with a chapter on work study as a service to management. The terminology used throughout the book is in accordance with BSS 3138:1959.

S.P.S.

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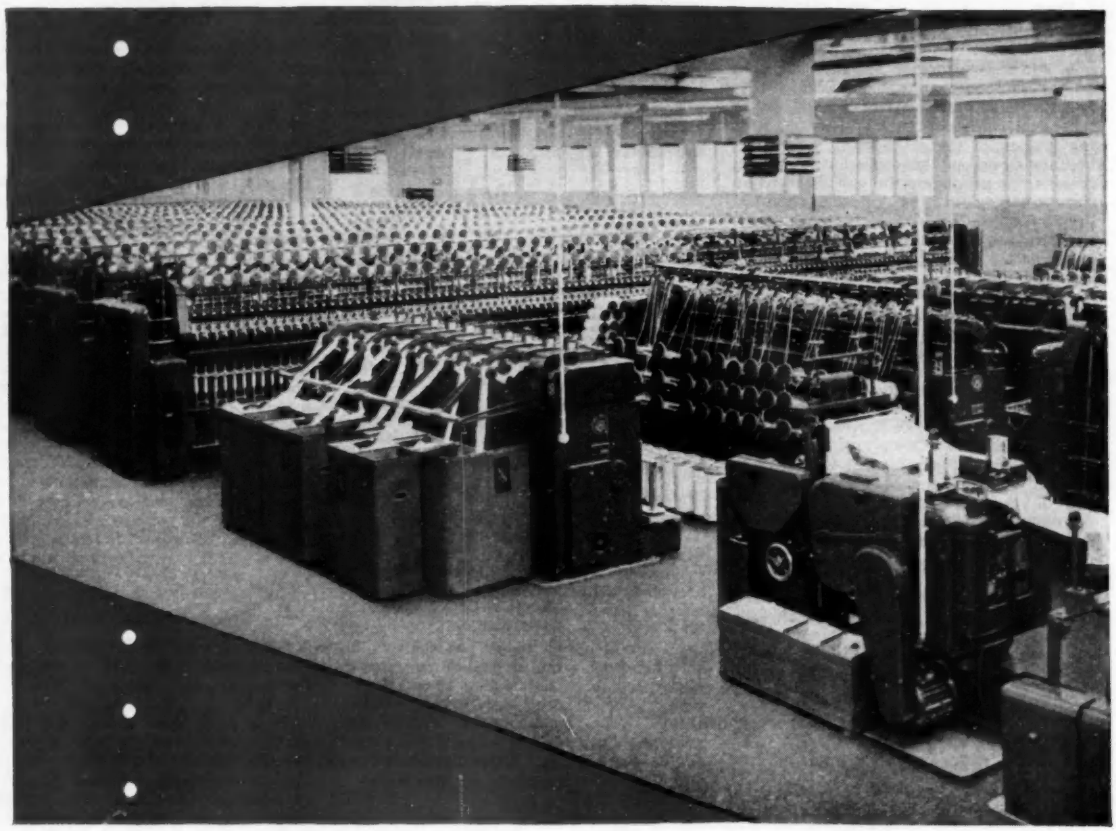

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DAVISON'S TEXTILE BLUE BOOK, Summer 1959 edition. Davison Publishing Co., Ridgewood, N.J., U.S.A. (price $9.75).

Despite its roughly 1,300 pages the Blue Book is no larger than many text books and into such comparatively small space is packed an immense amount of essential information concerning the textile enterprises of the U.S.A. and Canada. It contains the names and addresses of all textile plants in those countries arranged by locality, with the names of principal executives, together with full lists of dealers, converters, exporters, brokers and other handlers and processors of all types of textile raw materials, yarns and fabrics. Classified lists of cotton and woollen mills by products and complete alphabetical indexes to all mills, dyers and raw cotton firms make use of the directory extremely simple. The sources of supply of equipment and other industrial necessities are indicated in a buyers' guide section and textile schools and associations are also listed. There can be no question that the Blue Book is an essential guide to the North American textile field.

S.P.S.

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ASPECTS SCIENTIFIQUES DE L'INDUSTRIE LAINIERE F. Monfort. Dunod, 92 Rue Bonaparte, Paris 6e (price 7,000 francs).

Since the end of World War II, textile research has taken on a new aspect following the introduction of statistical methods with their numerous applications. For the benefit of those engaged in the woollen industry this book has been issued as a guide to statistical control techniques for employment in the production of woollen yarns, but its value will be apparent to readers belonging to other branches of the textile industry. The author, by virtue of wide industrial experience and of his position as professor at the Ecole Superieure des Textiles at Verviers, is well fitted to give guidance on this important subject. Bibliographical references are given at the end of each chapter.

S.P.S.

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CUTTING CLERICAL COSTS. Available free from the Secretary, Management Consultants Association, 4 London Wall Buildings, E.C.2. This latest "blue book" starts by emphasising the difficulty of discovering true clerical costs. An interesting table shows that between 1931 and 1951 clerical employees in England and Wales rose by nearly one million, and the proportion of clerical to all other employees rose from 6·7 to 10·4%. Thus clerical employees rose by 67%, while the total working population only rose by 8%. The booklet examines under various headings the different ways of cutting clerical costs and concludes by describing the specialists' experience and advice available from management consultants to cut this growing element in costs.

Trade Literature

FACTS ABOUT MAN-MADE FIBRES. British Man-Made Fibres Federation, Bridgewater House, 58 Whitworth Street, Manchester 1.

A third edition of this popular booklet is now available. When first produced in 1956 training of retail sales staff was the main objective, but the booklet has proved to be of much wider appeal. The second edition has been out of print for some time, but the new edition is similar in style and format to the two earlier editions. Various revisions have been made including additions to the section on bulked, textured and stretch yarns, and to the trade marks section. It is free on application to the Federation.

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DUTCH TEXTILE EXPORT DIRECTORY. N.V. Uitgeversnij. Diligentia Roemer Visscherstraat, 2-4-6, Amsterdam. Price £2 10s.

The fourth edition of this 744-page directory has been revised and improved by the compilers—the editorial staffs of "Textilia" and "Texpress." An alphabetical list of the manufacturing and wholesale trades has been included together with a list of trade marks. The directory is split into groups, thumb indexed for easy reference. Addresses for the various groups have been classified alphabetically according to provincial situation, an improvement which facilitates rapid searching. Contents and instructions are printed in Dutch, English, French, German and Spanish.

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NEEDLE BEARINGS IN TEXTILE MACHINERY. A lavishly illustrated 32-page booklet from I.W.A. Needle Bearings Ltd., Dafen, Llanelly, Carms., surveys many applications of needle bearings in textile machinery. Pointing out that rolling contact bearings considerably reduce friction, thus operating at higher speeds, the booklet lists other advantages including minimum radial dimensions, high loading capacity, rigid mounting, constant working clearances, and easy assembly. Many different applications are illustrated.

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MIDLAND SILICONE NEWS. Published by Midland Silicones Ltd., 68 Knightsbridge, London, S.W.1. The second edition of this new industrial news organ contains several industrial applications of silicones. They include silicones in heat-resistant paints, valve seal A; a new colourless, non-melting silicone grease, and the use of silicones in heat sealing.

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DIECASTING DESIGNING. Fry's Diecastings Ltd., Merton Works and Head Office, London, S.W.19. This booklet, the latest in the firm's series of technical publications, shows conclusively how the design of pressure diecastings can be arranged to provide a combination of desired properties, low cast, and good design. The information is conveyed pictorially to the reader in an easy-to-understand manner.

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HONEYWELL MILLIVOLTMETERS. A new folder from Honeywell Controls Ltd., Ruislip Road East, Greenford, Middlesex, describes the salient features and advantages of the Honeywell millivoltmeter. Constructional and design details are included, with information regarding the company's pre- and after-sales service.

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DU PONT MAGAZINE. Among several interesting articles appearing in a recent edition, is one of particular informative value to textiles. Entitled "Cleanup Chemical," the article concerns sulfamic acid, an easy to handle white powder with the strength of liquid acids. Water-cooled air conditioning equipment is said to lend itself particularly well to dry acid cleaning. Sulfamic scale removers can be added directly to the system, where they dissolve most calcium and magnesium based deposits without corroding metal. A 30-page booklet outlining sulfamic and describing some of the jobs to which it is suited is available free, from Du Pont Industrial and Biochemicals Dept., Nemours 2533-D, Wilmington 98, Del., U.S.A.

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NEW LABORATORY EQUIPMENT. An illustrated leaflet from Loughborough Glass Co. Ltd., Loughborough, Leics., gives details of six new products: nesting set of five rigid polythene breakers, bottle carrier to take four 20 oz. Winchesters, mercury collector, test-tube rack, rigid polythene scoop, and a moulded polythene bottle tray.

LOUVRES AND FLUORESCENT LIGHTS. The first of two new catalogues from Courtney Pope (Electrical) Ltd., 10 Chatham Street, Piccadilly, Manchester 1, describes a plane prismatic louvre, CP.1 and 2 white opal plastic louvre, and "Flouvre" anti-glare attachment. Specification and details are included in each case. The second, "Stripline Range," illustrates and features the 5 ft., 80 watt, batten fitting, showing several possible variations.

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WORLD SCREW THREAD STANDARDS. Published by W. H. A. Robertson and Co. Ltd., Lynton Works, Bedford (price 10s.).

Over 2,000 standards from 33 countries are collated in this unique 41-page publication. Designed primarily to provide comprehensive coverage of screw-thread standards throughout the world, the work identifies the thread forms by illustrations and lists the standards alphabetically by country of origin.

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DIELMOTH MOTHPROOFER. Product Application Sheet No. 33, produced by Shell Chemical Co. Ltd., Marlborough House, 15-17 Gt. Marlborough Street, London, W.1, enumerates the primary characteristics of "Dielmoth"; a self emulsifiable, durable concentrate, designed for ready application to wool and wool blends during processing. The booklet describes briefly the effect of "Dielmoth" on dyestuffs, bleaches, and oil and grease emphasising its permanency. It also includes four charts showing general application recommendations for different types of yarns and fabrics.

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TEMPERATURE MEASUREMENT. Four assorted leaflets and catalogues have recently been released by George Kent Ltd., Luton, Beds. Publication 265 gives brief details of the operational principles and general features of various indicators, recorders, and controllers. Details of the company's after-sales service are set out in publications AS.1 and 2, and publication IS.18 is a spare parts list for the tractor wheel type integrator.

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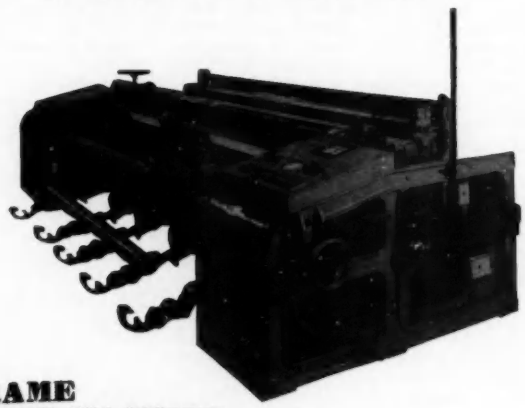

Tube frame threaded with the spool in its spring holders: eliminates four operations (patents pending). Needles are brought forward by simple foot operated switch, leaving operatives' hands free to attend to interrupted ends and return to thread by the same operation. Tube frames can be threaded as fast as removed from the chain, thus facilitating immediate return to their last position in the chain. All needles have rounded crochet hook ends, preventing yarn damage and enabling smoother threading. All spool end strive difficulties overcome enabling, 100% threading even if strive is as much as 1" by our new full length comb. By fitting side supports the standard 4/4 machine can thread 2/4 to 16/4 Tube frames, or a machine can be supplied 12/4 in width. Tube Frame automatically clamped eliminating still a further hand operation.

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Textile Trade and Prospects

Linen Trade Review

The war now being waged between rayon and nylon to capture the motor tyre market seems, on the surface, far removed from trade frontiers of the linen industry. Yet an analysis of relevant factors shows that it is perilously near. Linen manufacturers long ago lost interest in the motor tyre industry as a possible market for their products, but the price battle now being waged between the two major man-made fibres has resulted in price cutting by these, which are at present also strongly competitive in the domestic field with linen on a price basis. Improvements in manufacturing techniques, and the economies made possible by greater bulk production as demand expands cannot, unfortunately, be matched by corresponding savings in flax production, and unless this can be effected in the near future linen will eventually be priced out of its principal markets.

Raw material constitutes a major part of the yarn cost. Consequently whatever economies can be effected in manufacture by the installation of modern equipment can be easily offset by an upward movement in flax prices. This has occurred frequently in recent years and is undoubtedly a deterrent to modernisation in many instances, particularly so as some mills which carried out re-equipment programmes have since been compelled to close down.

Nevertheless, steady progress in re-equipment is being made in the spinning section. Ring spinning is now accepted practice for coarse and medium count yarns, and it will undoubtedly be extended in time to cover the whole wet spun count range. The success achieved by Continental spinners, together with its possible solution of the raw material supply position, have revived interest in rove boiling for unretted and low grade retted flax, to extend the spinning range. Elimination of extraneous matter at this stage is also effective in improving the spinning performance of ring frames, and permitting economies in subsequent manufacturing operations.

In a recent address to the Belfast Society of Chartered Accountants on "The Resurgence of the Irish Linen Industry" Sir Graham Larmour expressed the view that while some firms might still be forced to close down, or be absorbed in one way or another, the redundancy problem was now approaching a solution, and there remained a solid phalanx which could be counted on to uphold the tradition of the industry, and maintain a secure place for it in the years lying ahead. Recent statements by the N. Ireland Ministry of Commerce indicated that upward of £15 millions had been spent on re-equipment in the industry within the period 1949-58. With a few exceptions the money had been well spent, and under proper direction and management the member firms were in a position to reap the benefit of this considerable investment. Most units are now working to capacity, their principal problem being to secure and maintain the necessary skilled labour force.

However well equipped the manufacturing section may be its prosperity is, in the last resort, dependent on availability of an ample supply of raw material at a price which will make its end products competitive. So long as it is completely dependent on overseas sources for its flax and tow it is subject to all the hazards which such dependence implies, not the least being price exploitation which, as experience has shown, can swamp the maximum production economies made possible in the most up-to-date mills. This is a major problem to which an answer must be found if the industry is to maintain its footing in world markets for textiles.

The response of domestic growers to extend the acreage this year seems likely to be on a par with the stimulant offered by the N. Ireland Government under its guaranteed minimum price list, which is on a level with that of two years ago and makes no allowance for the substantial advance in labour costs in the interim. Latest reports from Continental centres forecast a slight increase in acreage by west European countries, although processors still maintain that current market values are uneconomic.

Wool Production and Consumption

Overseas demand for Australian wool inevitably will be towards the increasing sale of greasy wool, says R. B. McMillan, director of the Australian Wool Bureau's wool statistical service. In recent seasons Australia's wool production had been disposed of as follows: 75% was exported as greasy wool; 5% was exported as sheepskins; 12½% was scoured or carbonised before export, and 7½% was consumed by Australian mills. Mr. McMillan pointed out that the 750,000-ton clip was classified into nearly 3,000 separate types of wool distinguished chiefly by quality, breed, length, style and burr content. Yet even this did not accurately describe the wools within each type. "The range of wool types may, in fact, be likened to a multi-dimensional spectrum," he said. "Each user is interested in his own particular segment of this range, as dictated by the end-products he produces and his particular processing techniques. Thus the vast demand for our wool will continue to be for raw wool because here the manufacturers can best tell the exact characteristics of the fibre."

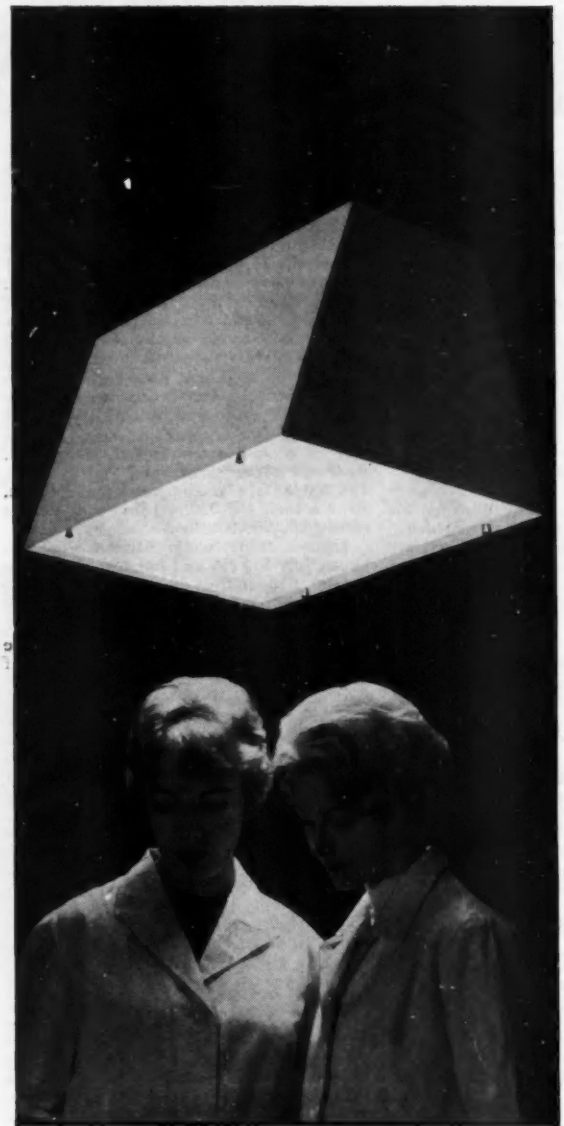
Britain's wool consumption and her output of wool textiles showed further rises during January. Wool consumption was 3% higher than in December, and 3% more than in January, 1959. Top production was 3% higher on the month and 2% more than in January, 1959. Worsted yarn deliveries showed greatest improvement, being 5% higher than in December and 15% above January, 1960. The wool fabric delivery rate showed a 6% increase on a year ago. January output totals were: wool consumption, 44·65 million lbs. (clean weight); top production, 29·98 million lbs.; tops drawn, 19·73 million lbs.; worsted yarns delivered, 20·97 million lbs.; woven wool fabrics delivered, 31·88 million sq. yds., and blankets delivered, 2·93 million sq. yds. Russia is once more a major buyer of Australian wool. In the seven months ended January 31 last, she imported 24,000,000 lbs. of Australian wool, valued at £6,000,000. There were no Australian wool exports to Russia during the same period of the previous financial year. At the end of January Russia was seventh in the list of importers of Australian wool. Australia's best customer, Japan, took 185,000,000 lbs. during the seven months. Britain took 169,000,000 lbs., and France nearly 100,000,000 lbs.

Income from South African wool between July 1, 1959 and January 31 last was nearly £10 million more than for the corresponding period last season, states the South African Wool Board. The wool cheque was £34 million at an average price 42·8d. per lb. Despite the effects of drought in many of the main South African wool-growing areas, wool receipts also rose from 182 million lbs. to 192 million lbs. Although the market was somewhat weaker during January and necessitated bidding by the South African Wool Commission in support of prices of certain lots, the Commission was not called on to buy any wools at its reserve price levels. In fact, the margin between market and reserve prices was sufficient to enable the Commission to dispose of a further 2,400 bales from its stocks at satisfactory levels, leaving a balance of 4,700 bales. Britain bought 33 million lbs. of greasy and scoured wool.

Jute Fibre, Yarn and Fabrics

Raw jute markets have been firm in Pakistan and prices of most grades have advanced. The position in Dundee has been irregular because a fair amount of secured material was offered at under the generally quoted rates. This tended to give a false impression of the market but once these secured parcels have been completely taken up by spinners, prices could become dearer without any rise taking place in the Pakistan market. However, spinners have not shown much interest in supplies and the bulk of the business has been confined to spot and afloat lots. Spinners still hold fair stocks of raw material but it is estimated they will have to secure a further 150,000 bales of jute before the next crop is available.

Stocks of raw material held by Continental spinners are not large and a considerable amount of buying will have to take place before the end of the season. The quantity of fibre available from the present crop should be sufficient to meet demands but the selection of grades may be difficult. A few offers of new crop were made earlier in the year, but since prices became firmer practically no offers have



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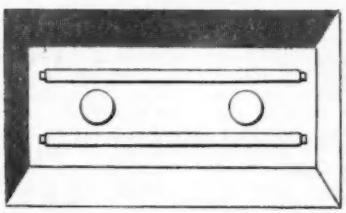

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been made. Sowings are being delayed because of lack of rain. However, this is not expected to have much influence on prices at present but if the next crop is late prices could advance rapidly. E.P.C. values of most grades of the fibre rose during the past month and are now well above minimum levels. Prices of the lower grades of white jute have shown the largest increases. Offers are now being made at £113 10s. for Mill Firsts, at £100 10s. for Mill Lightnings, at £93 10s. for Mill Hearts and at £81 for grade Hearts, c.i.f. U.K., for Mar./Apr. shipment. These prices are mostly for secured parcels and some shippers are asking £3 to £4 per ton more than the above rates. The dark jute position has not shown the same advance and Tossa-2/3 is available at £111 10s., Tossa-4 at £99 10s. and Continental Tossa-2/3 at £94 10s. Crack Daisee-2/3 is available at £99 and Daisee-2/3 at £90, c.i.f. U.K., Mar./Apr.

It has been announced by the Pakistan authorities that licences will no longer be required for the growing of jute. This announcement was welcomed by all raw jute consuming countries as a move in the right direction but it must be remembered that last season the total licenced area for growing jute was not taken up by cultivators. The problem posed by freight rates on raw jute was examined at a recent meeting in Paris of the executive board of the Association of European jute industries. Approaches were made to the Secretariat of the Continent/India-Pakistan conference but it was stated that European spinners would not be granted the benefit of the reduction which was general on the freight market for their shipments of raw jute. The Association say this decision is aggravating the position of European jute products on international markets.

The Calcutta goods market has fluctuated within narrow limits during the past month. U.K. buyers have shown some interest but nothing of an outstanding nature has taken place. Quotations are now at 62s. 6d. for 10 ozs. 40 ins., and at 48s. 3d. for 7½ ozs. with 11 ozs. 45 ins. at 69s. 2d. per 100 yds. f.o.b. Calcutta for March shipment, and at 62s. 9d., 48s. and 69s. 6d. Apr./June. B twills were quoted at 169s. Mar. and at 167s. Apr./June. Stocks of goods held by the Indian mills at the end of February showed little change in the case of either hessians or sackings. The quantity of hessians held by the mills decreased by 200 tons during Feb. but sackings increased by 100 tons. The stocks of miscellaneous cloths increased by 1,600 tons compared with the position at the end of the previous month.

A fair steady demand is being shown for jute yarns at Dundee and spinners remain busy. It is difficult to obtain supplies in the near delivery position as spinners are fully sold. The carpet trade is still taking regular deliveries but there is some reluctance to place orders in the forward position. The cloth position remains satisfactory with manufacturers fully employed. A good demand is being shown for wide material and very little of this type of material is available over the next few months. The heavy end of the trade is now a little quieter and there is a lack of interest for sackings.

Cotton Yarn and Cloth Activity

In contrast to the feverish buying activities of the last few months, present yarn and cloth markets are a little more cautious in view of the effects on cost of higher wages and the forthcoming budget. Although inquiry has covered practically every type of yarn and cloth the actual volume securely booked has been noticeably less in the last few weeks. Whatever optimism was created by the improved tone in market transactions it has not completely eliminated the overall gloom created by the extent of the scrapping programme. In the minds of many—management and operatives—the view is still firmly held that a considerable proportion of the plant and machinery has been ruthlessly sacrificed because of the over-generous compensation for scrapping. Some excellent producing units should never have been allowed to go out of business. Scrapping first-class machinery does nothing at all to increase the efficiency of those still in business or in helping them to meet increasing competition. Excellent in principle, the scheme has, nevertheless, resulted in many "half-baked" ideas that scarcely bear examination. Real values in terms of shareholders, management, operatives and machines have been completely lost in the stampede to register for compensation. Incidentally, it is somewhat nauseating to see the gulf between the compensation terms for operatives and the fantastic sums being asked by some directors, etc., for so-called "loss of office." The sooner this unfortunate period is over and the better will be the general atmosphere throughout the trade.

Most counts and qualities of yarns have been dealt in although some fluctuations in raw material prices had a disturbing influence temporarily. Spinners on the whole are quite busy on existing contracts but a little afraid of committing themselves too far ahead on new accounts. As usual, the bulk of the orders have been on home trade account with a large proportion absorbed by orders for standard weaving qualities on ring beams, cops, cones, hanks and cheeses. Carded counts are in good demand and much better support has been accorded to combed mule spun doubling wefts. Coarse counts are in keen request with accent on early deliveries and condenser yarns are selling very well indeed. One or two Continental markets have shown more interest in recent weeks. All classes of blended yarns and fancy folded varieties find immediate outlets.

Business in cloth continues very good although one or two manufacturers report only spasmodic interest. Dress goods in an infinite variety of dobby and jacquard designs, also beautifully coloured screen and roller printed fabrics lack no buying interest. Blended cloths in cotton/rayon, cotton/nylon, etc., are well supported and all classes of shirtings are finding favour. Furnishing fabrics are in very good demand and some original designs cannot be produced fast enough. Household textiles sell well and a new sort of "terry-type" quilt is arousing keen interest. Greater interest is evident in some industrial cloths but export outlets are not much better in interest or off-take.

Silk and Man-Made Fibres and Fabrics

In the silk and man-made sections of the industry order books, in general, are in a far healthier state than for a long time. The demand for silk-like fabrics has led to heavy calls for acetate and deliveries appear to further stimulate orders. Although the trade is now thinking in terms of autumn fashions, wholesale and retail houses continue to build up stocks for summer. Fabrics in keen request include both roller and screen printed dress types featuring large floral designs and—given a crease-resist finish—these fabrics are assured of good sales. In shirtings, blends of "Terylene"/cotton retain their popularity, as do all-rayon tunic shirts, and cloths of nylon/acetate mixtures for sports shirtings. Drip-dry finishes on these cloths are key selling points. Furnishing fabrics in steady demand include all-rayon and cotton/rayon yarn constructions in bright designs of traditional and contemporary character. Prints for curtains and covers, etc., sell well in duplex printed styles in very fast colours.

In Yorkshire the woollen and worsted sections are both extremely active and "Terylene," "Acrilan," "Courtelle," "Orlon" are all being very effectively used in yarn and cloth constructions. Nylon- and rayon/wool blends are in very encouraging request for a wide range of suitings in the medium price brackets. There is also an increasing off-take of blended yarns for tufted carpeting industry. New developments in carpet printing have given additional impetus to this thriving section. In the Midlands, most classes of hosiery yarns are in steady demand and deliveries tend to lengthen as the demand increases steadily. Nylon and "Terylene" tricot fabric is booked up well ahead by a large number of making-up concerns who are urgently pressed for forward deliveries.

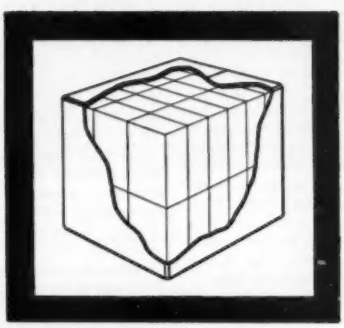
In the stocking trade seamless hose is still in heavy demand partly because of the all-round cheaper retail prices and partly because of the existing fashion requirements.

Leek and Macclesfield sections are fully employed. Screen and machine printers report lengthening order books from the demand for most classes of ties, handkerchiefs, head-squares, etc., and so on. Another very pleasing factor is the big revival in silk which has resulted in this area being busier than for some years. The demand for bulked yarn is heavy and considerable interest is being shown in these for knitted outerwear. The position in knitting is much better than in February, 1959. Autumn ranges are being well received and order books show great improvement, particularly regarding knitted scarves and millinery. Most of the present activities, of course, are on home trade account but export markets are still difficult, but there are signs of relaxation in some quarters although increases in quotas are not always taken up by the importing country. Woven and braided smallware markers have a better tone and show improvement over recent months in the home market but the export prospects remain tough.

Announcement

Barke Machinery Ltd., Ashton-u.-Lyne, inform us that they have relinquished the agency for Jagri G.m.b.H. of Gescher, Western Germany.

TOP FLIGHT CASES



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Notes and News

Colours for Autumn and Winter 1960

Colours for Autumn and Winter 1960, issued by the British Colour Council, include two distinct types, clear and bright, gentle and mellow. Colours clear and bright are shown on wool and on the range for silk and man-made fibres. Included are young pinkish reds ranging from Pink Starlight, through Pink Radiance and Rambler Pink to Radiant Red, Red Gleam and Crimson Rocket. Among the lilacs and violets, taken up only tentatively when first introduced several seasons ago, and now winning acceptance are Venus Violet, Lovely Violet and Mercury Violet on the wool range and two parma violet types Comet Violet and Magnetic Violet on the silk and man-made fibres card.

Turquoise and copper green colours range from Turquoise Blue through Meteor Blue to a glowing coppery green Green Zenith on the silk and man-made fibres card, and from Meteor Blue through Green Zenith to Planet Green on the wool card.

Autumn woodland colours include Richmond Brown and Nutmeg, Russet Pink and Bracken Rose, particularly effective in soft wools, tweeds and mixtures. Coral tinted browns called Goldenglow, Hazelnut, Squirrel and Auburn are on the silk and man-made fibres range. Also included in this group are colours which show a development of the Willow Leaf colour so popular in the Spring. Autumn versions of this are Lakestone and Windermere Green on the wool card.

The ten colours for knitwear and hand-knitting yarns reflect the colour trend noted on the wool and silk and man-made fibres ranges. Gay "younger set" colours include Echo Blue, Chinese Turquoise, Venetian Scarlet, Minorca Blue and Toledo Tan. More subdued, but still colourful, are Fuchsia Pink, Winter Violet and Citron Yellow. A range of twenty-two colours offers a wide choice of colour harmonies for cottons. New Trends are blue greens, Cricket Green and Fiesta Green, corals, Tiger Lily and Goldenglow and warm earth tans, Sunny Tan and Toffee Tan.

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Taylor Woodrow Mill Contract

Taylor Woodrow (Nigeria) Ltd. have been awarded a contract to a value exceeding £200,000 by Kaduna Textiles Ltd. for the design and construction of an extension to the existing textile mill at Kaduna in Northern Nigeria. The managing agents of Kaduna Textiles Ltd. are David Whitehead and Sons (Nigeria) Ltd., a subsidiary of the old-established firm of David Whitehead and Sons Ltd., Rawtenstall. The building will be a "north-light" Arcon structure (supplied by Taylor Woodrow (Building Exports) Ltd., London, the marketing member of the Arcon Group) covering 165,000 sq. ft., and similar to No. 1 mill which, together with the bleach and dyehouse recently completed, was also designed and constructed by Taylor Woodrow (Nigeria) Ltd. No. 1 mill was constructed during 1957 and has been a successful venture. Because of an increase in demand it has been decided to proceed with the construction of this second textile mill, and when completed the total manufacturing floor area of the company will exceed 350,000 sq. ft.

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Cotton Industry for Ghana?

In a message from Accra, Barclays Bank D.C.O. says that Ghana's Ministry of Food and Agriculture is considering establishing a cotton industry in the Kpandu district. Experiments are being made with both short and long-staple varieties.

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Cotton Ginning Research

At the cotton spinner breeder conference held in Liverpool and Manchester last July, it was suggested there was considerable scope for research in ginning raw cotton, and representatives from the Sudan and East Africa offered facilities to Shirley Institute should any member of the staff be able to make a visit. Arising out of this suggestion arrangements have now been made between the Empire Cotton Growing Corporation and Shirley for Mr. L. H. C. Tippett (assistant director) to visit Sudan, Nigeria and Uganda to advise on possible researches into the ginning process. On his return Mr. Tippett will prepare a report outlining a possible research programme that might be undertaken in the interests of all concerned.

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New Plain Wilton Carpet

A new range of uncut single-frame woollen Wilton 3/4 body carpet has been introduced by T. Bond Worth and Sons Ltd. (Stourport-on-Severn, Worcs.) under the trade-name "Everest." First samples will be shown to the trade at the Carpet Fair. "Everest" will be available in nineteen plain colours, chosen specially from the "House and Garden" range to blend with the existing range of Florette rugs.

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Baker Perkins/Forgrove Sales Arrangement

Baker Perkins Ltd. and Forgrove Machinery Co. Ltd. announce that responsibility for sales of wrapping and packaging machinery to all non-food trades within the British Isles is now transferred to the Forgrove company. All non-food trade enquiries are being handled by Forgrove from their headquarters at Dewsbury Road, Leeds 11. This transfer of responsibility applies not only to the extensive range of equipment manufactured by Forgrove but also to the wrapping and packaging machinery for which the Baker Perkins Group has the agency in the British Isles, including equipment manufactured in the U.S.A. by Package Machinery Co. and R. A. Jones and Co. Inc. and in Germany by Höfliger and Karg.

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New Appointment

Light Alloy Construction Ltd., Darlington, have appointed Mr. S. Scaife to represent them in the textile industry for the sale of light alloy handling containers especially designed for use in the textile field. Mr. Scaife was formerly mill manager for John Broadbent and Son Ltd., Droylsden.

I.C.I. Introduce New Dye

Compared with the earlier Procion Rubine H2BS, which it will replace to a large extent, Procion Rubine HBS, a new dye announced by I.C.I. Dyestuffs Division, is said to have better solubility, superior building-up properties, and yellower and somewhat brighter in shade. In textile printing, where the main value of the new dye is expected to be found, a further advantage is the virtually complete absence of staining of whites when washing-off prints, while the higher solubility of Procion Rubine HBS permit it to be printed at higher concentrations. In dyeing, Procion Rubine HBS can be applied to cellulosic fibres by all the continuous and semi-continuous methods established for Procion "H" dyes, giving attractive bluish red shades of high level and washing fastness and good colour value.

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Knitting Wool Trade Fair

The second Knitting Wool Trade Fair will open in the City Hall, Manchester, on September 5th, 1960. The choice of Manchester is expected to be popular with trade visitors, being situated in a thickly populated area with more knitting wool shops than any other county in England. It also has first-class communications with other parts of the country and is only four hours by rail from London. Visitors from abroad, will happily be able to fly direct to Manchester Airport.

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Laporte Chemicals Ltd.

The company announce that they have retained the services of Mr. C. Garrett, F.T.I., in an advisory capacity to their textile technical and customer service organisation. Mr. Garrett is well known in the cotton industry for his considerable experience in bleaching and dyeing and particularly for bleaching processes based on hydrogen peroxide and sodium chlorite. Laporte Chemicals Ltd. are to start manufacturing sodium chlorite as an addition to their range of bleaching products.

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Progress Report

Chemstrand Corporation's report of its tenth year of operation, shows that in 1959 sales had risen to over 197 million dollars, with a consolidated net income of over 24 million dollars, a 31% increase over the 1958 figure of 18·36 million dollars. Highlights of the year included the start-up at Coleraine, N. Ireland, of the Acrilan fibre plant. Acrylic fibre plants of affiliated companies in Japan and Italy also commenced operations in 1959.

• • •

New Drum Stacker

Tubular forks are fitted to this new foot-powered, twin-speed, hydraulic drum stacker introduced by Lodematic Ltd., Clitheroe, Lancs. Of telescopic design, and only 28 ins. wide, the overall height decreases as the forks lower; low doorways and narrow gangways are easily negotiated. Drums up to 500 lbs. are raised at a steady speed, whilst lighter drums are lifted more rapidly, but with equal ease, in the "fast speed" position. A knurled knob at hand level controls speed of descent, and drums

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CRABTREE

GUIDES THAT LAST A LIFETIME

STANDARD SINTOX ceramic thread guides save expense and give indefinite life.

This is one of the Cooke Creels at the Melbourne, Derbyshire factory of Thomas Haimes and Company Limited. For the processing of nylon yarn STANDARD SINTOX thread guides have been adopted.

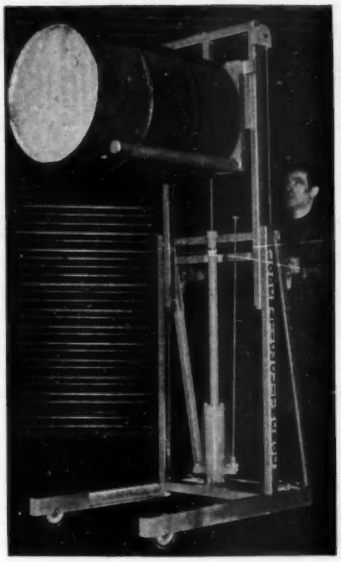
The Creel takes 2,368 eyelets and 672 tubes. Whereas the cost of fitting this Creel with special SINTOX guides would have been £119, the adoption of items from the SINTOX STANDARD RANGE has meant a 55% reduction in expenditure . . . and SINTOX never wears out.

Technical advice on the application of SINTOX guides will be given without obligation by the selling Agents:—
Crabtree Textile Accessories, Colne, Lancs. Telephone Colne 985 & 499
or the manufacturers:—
LODGE PLUGS LIMITED, RUGBY, SINTOX DIVISION. Tel. Rugby 2076

SINTOX

CERAMIC THREAD GUIDES

T.1



"Lodematic" pedal powered hydraulic drum stacker

can be halted at any height for discharge into process plant or for off-loading on to racks or vehicles.

Needle bearing wheels, for ease of movement, are located in the straddle arms. Oversize wheels are available where it is required to propel the drum stacker over uneven ground or considerable distances. A parking brake is an optional extra. "Plug-in" mains and battery-powered electric versions are also offered.

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Northrop Sales

British Northrop Ltd. have set up a separate sales company entitled British Northrop Sales Ltd., which will direct its activities entirely to the provision of the fullest possible services to customers. The first directors are Mr. H. de G. Gaudin, chairman; Mr. G. L. G. Jackson, managing director, and Mr. A. V. Lepere. The new company will exhibit at the American International Textile Machinery Exhibition at Atlantic City, U.S.A., in May when machinery representative of the Northrop range of high speed automatic looms will be shown.

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Elected on Court of Governors

Mr. A. F. W. Coulson, B.Sc., F.T.I. (director, R. Greg and Co. Ltd., Reddish) has been elected Textile Institute representative on the Court of Governors of Manchester College of Science and Technology.

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Dyehouse Information

I.C.I. Ltd., Dyestuffs Division, Blackley, Manchester. The following technical information sheets have recently been issued:—

No. 527—Procion Brilliant Blue H7GS: Application to Cotton in Jig or Package-Dyeing Machines.

No. 531—Wool Dyes: Fastness to the "Immacula" Finish for Durable Pleating.

No. 532—Weathing Fastness—Azoic Dyes.

No. 533—Light Fastness of Dyestuffs: I.S.O. and A.A.T. C.C. Ratings.

No. 534—Fixanol PN: Use with Copper Salts for After-treating Direct Dyes.

No. 535—Procion Dyestuffs: Application to Wool.

No. 536—Wool Dyes: Effect of the W.I.R.A. Peracetic Acid/Sodium Hypochlorite Shrink-Resist Finish on Shade and Wash Fastness.

No. 540—Procion Brilliant Blue H7GS: Dyeing of Cellulosic Fibres by Batchwise and Pad-Roll Procedures.

FAST DYEINGS ON WOOL-CELLULOSIC UNIONS. D. R. Lemin and J. K. Collins. I.C.I. Ltd., Dyestuffs Division, Blackley, Manchester.

By careful selection of dyes and dyeing methods, it is possible to apply reactive, onium, vat and azoic dyes satisfactorily to wool-cellulose unions without causing significant fibre damage.

EMULSION THICKENINGS—POSSIBILITIES IN TEXTILE PRINTING. T. L. Dawson. I.C.I. Ltd., Dyestuffs Division, Blackley, Manchester.

Theoretical and practical aspects of these emulsion systems are considered and the advantages of oil-in-water emulsions over the water-in-oil type are set out.

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New Standard

STANDARD FOR YARN CONES. British Standards Institution, 2 Park Street, London, W.1 (price 6s.).

This revised publication (B.S. 2547 : 1960) specifies a range of seventeen cones and centres designed for winding continuous and discontinuous fibre yarns. Paper cones are specified for ordinary winding and warping; wood cones for high speed warping; and metal cones for the pressure dyeing of yarns. In view of the increasing tendency towards the bleaching of flax yarns after winding, metal centres of 5-in. and 6-in. traverse are provided for, together with the necessary paper transfer tubes. The cone angles included in the standard are: 3° — 30 ft. for ordinary purposes; 4° — 20 ft. for yarn dyeing; 9° — 15 ft. for hosiery yarns and parallel centres for bleaching flax yarns.

STANDARD FOR DOFFING BOXES. British Standards Institution, Sales Branch, 2 Park Street, London, W.1. (price 3s.).

Both manufacturer and user are likely to welcome this new standard (B.S. 3201 : 1960) for doffing boxes. Two basic sizes specified offer the user a satisfactory choice and they can be manufactured in any suitable material. No constructional standards are laid down. The two widths specified will take ring bobbins or tubes up to 11½ ins. and 13½ ins. overall length.

COILER CANS. British Standards Institution, 2 Park Street, London, W.1 (price 4s.).

This revised publication (B.S. 2047 ! 1960) specifies basic dimensions for coiler cans used in the cotton, cotton waste, woollen and worsted, flax, hemp, jute and sisal trades. In view of the present trend towards the use of larger cans, the tables have been expanded to include additional sizes; and, where necessary, dimensions are given for cans with recessed base suitable for the latest developments in machine design. The tables include sizes which have been agreed by the International Organisation for Standardisation (Technical Committee 72 on Textile Machinery). Publication of the I.S.O. Recommendation is expected in 1960.

European Service

Du Pont de Nemours International, S.A., has set up facilities in Rotterdam, Holland, for bulk storage and delivery of dimethylformamide (DMF) and 40% aqueous dimethylamine (DMA). Du Pont dimethylformamide (DMF) is a colourless, low viscosity liquid claimed to have outstanding solvent power for a wide variety of organic and inorganic materials. For example, it is widely used as the spinning solvent for fibres made of poly acrylonitrile and its co-polymers. DMF benefits many types of reactions such as substitution, elimination, addition, and coupling. Another usage of DMF arises from its high acetylene solubility and selectivity.

The dimethylamine offered is a 40% aqeous solution of DMA. Dimethylamine is used in the manufacture of sodium dimethyldithiocarbamate, an intermediate for the other salts of dimethyldithiocarbamic acid and for the production of a series of tetramethylthiuram sulphides. Dimethylamine is an intermediate in the preparation of tertiary amines which in turn are used in the preparation of quartenary ammonium salts. These are used as industrial bactericides, fungicides, and as textile softeners and surface-active agents.

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Wire Healds

The address of the sales office of Wire Healds Ltd. is Box No. 46, Textilatie House, Audley Range, Blackburn, Lancs.

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Jeremiah Ambler Choose Northern Ireland Again

Negotiations are reported to have been completed between the Northern Ireland Development Council and Jeremiah Ambler Ltd. for the establishment of a new factory at Ballyclare, Co. Antrim. The new factory, which will be erected by the Ministry of Commerce on a site of approximately 40,000 sq. ft., will be for spinning synthetic and other fibres. It is hoped to commence production towards the end of 1960, and when the plant is in full operation to employ approximately 140 operatives of whom half will be men. It is expected that eventually the size of the factory will be doubled. The firm has been operating in Northern Ireland since 1947 when they established a plant at Carrickfergus for spinning worsted yarn. This plant has been running almost continuously on shifts since that time and now employs 450 operatives.

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New Appointment

Mr. C. I. Rutherford has been appointed production director of I.C.I. Fibres Division with effect from April 1, 1960. He succeeds Mr. W. F. Osborne who is retiring after thirty-four years' service with the Company and its predecessors. Mr. Rutherford, who is 41, has been a director of Fibres Division since September, 1958. He began his career with I.C.I. in 1946 with the Technical Department of Head Office.

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New Appointments

Fine Spinners and Doublers Ltd. announce that Mr. P. S. Dixon has been appointed to take charge of their subsidiary Deltapine Ltd., raw cotton merchants and brokers, Liverpool.

Courtaulds Ltd. announce that the Right Hon. Aubrey Jones, M.P., has been appointed a director of the company.

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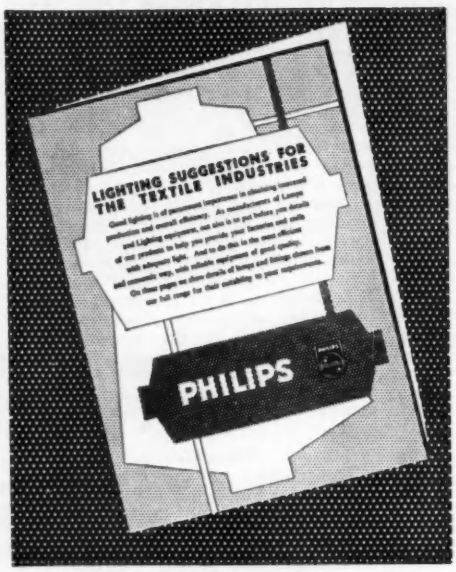

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RECENT TEXTILE PATENTS

These abridgements are republished from specifications by permission of the Controller of H.M. Stationery Office. The full specifications can be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2. Price 3s. each.

808,700 Folding or Rigging Machines
WILLIAM WHITELEY AND SONS LTD., *Prospect Ironworks, Lockwood, Huddersfield.*

A rigging machine in which the weft threads of fabric which are pulled back at the centre of the material are straightened by applying drag to the selvedges of the material during the rigging process. Fabric 10 from a roll 12 passes over an inclined triangular rigging board 14, supported at its apex by part of the machine frame 15. The material is then folded inward upon itself over rigging bars 16, to pass down between these bars in a folded condition to a pair of rollers 18. The selvedges of the material are indicated at 17 and the fold at 19. The centre line of the material passes over the apex of the rigging board, then over a belt 20 passing over a roller 22, and then over the upper ends 24 of the bars 16. The belt 20 is used to displace the material in order to correct any unequal folding, but it also exerts an additional drag on the material and this drag sometimes causes the weft to be pulled back at the centre so that in the folded material the threads are inclined to a right angle with the selvedges. A bracket 23 is fixed across the lower end of the frame 15, and near each end this bracket is formed with two slots 26. A block 28, which supports rod 30 is fastened to each end of bracket 23 by bolts 32 which pass through the slots 26, and nuts. By slackening the nuts, and altering the positions of the bolts, the position and angle of inclination of each of the rods can be varied. If it is found that the threads are being inclined by the friction of belt 20, the blocks 28 are adjusted until the rods 30 press on the selvedges (and if necessary on the outside face) of the material to provide sufficient drag on the weft near the selvedges to counteract the drag caused by the belt, and thus to keep the weft at right angles to the selvedges.

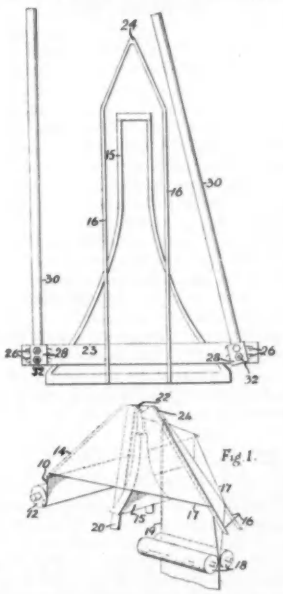


Fig. 1.

808,741 Ribbon Looms
JAKOB MULLER, *of Frick, Aargau, Switzerland.*

Relates to a loom having a rotary looping member bearing a bobbin carrying the catch thread, the weft being drawn from a fixed bobbin into the warp by a picking member, to be engaged and looped around the catch thread bobbin by means of a notch in the periphery of the looping member. The looping member has a cylinder carrying gear teeth let into its peripheral surface so that their tips lie flush with the remainder of that surface, on which the looping member is mounted for rotation. The notch is a single V-shaped incision which is inclined forwards to face in the direction of rotation of the looping member, the gear teeth being engaged by driving means on two points.

808,822 Eliminating Starting Places in Weaving
METAPIC S.A. HOLDING LUXEMBOURGEOISE, 144 *Rue de Hollerich, Luxemburg.*

A clutch device for looms, comprises a driving element located between two driven elements, and elastic strips are freely supported on the rear face of one of the driven elements. Each strip is in contact with a push rod associated with a rocking lever pivoted at one end to the hub of the second driven element. Each of the rocking levers is provided at its free end with a roller, the rollers bearing on a common cam mounted slidingly and with gentle friction on the crankshaft of the loom. The cam is driven by the operating mechanism of the clutch so as to perform a small sliding movement on the crankshaft.

808,857 Test Spinning Frame
SKF KUGELLAGERFABRIKEN GESELLSCHAFT MIT BESCHRANKTER HAFTUNG, 13 *Ernst Sachs Strasse, Schweinfurt am Main, Germany.*

A test spinning frame wherein the drafts of the drafting mechanism, and the speed of the delivery rollers are infinitely variable during spinning. The drafting mechanism has three pairs of rollers, and three gears are provided in such a manner that, in relation to a driving motor, the speeds of the delivery rollers, feed rollers and intermediate rollers can be varied by the first gear, the speeds of the feed rollers and intermediate rollers can be varied by the second gear and the speed of the intermediate rollers only can be varied by the third gear. Another feature provides that during spinning, the unevenness of the roving feed and of the yarn delivered may be measured by means of at least one measuring device. Two measuring points may be provided close to the drafting mechanism, one point being placed at the rear of the feed roller and the other in front of the delivery rollers.

808,882 Fibre Blending Arrangements
TWEEDALES AND SMALLEY LTD., *Globe Works, Castleton, Rochdale.*

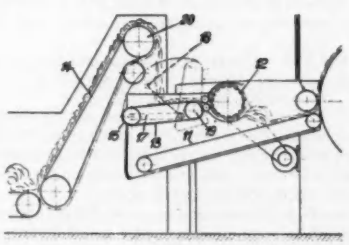
A method of blending two or more batches of different fibres comprises continuously feeding each batch of fibres in a lap or layer, and passing each lap continuously over weigh means. The rate of feed of each lap is adjusted in response to the weighing to maintain a predetermined quantity of fibre per unit length of the lap or layer; superposing the two or more laps, and continuously advancing and subjecting the superposed laps to an opening operation.

809,021 Pile Wires in Carpet Looms
BRINTONS LTD., 1 *Exchange Street, Kidderminster.*

A Wilton type loom embodies jacquard-controlled means for raising warp yarns from at least two different frames of yarn in the body of the fabric, to two different heights so as to form a two part shed, one part being inclined to the plane of the body at a smaller angle than the other part. Means are provided for inserting one wire of a double-pile-wire unit between the two parts of the shed and a second wire of the unit between the body of the fabric and the part of the shed which is inclined at the smaller angle.

809,134 Fibre Feed Change Mechanism
FLEISSNER AND SOHN MASCHINENFABRIK, *Wolfsgartenstrasse 6, Egelsbach-Frankfurt/Main, Germany.*

Improved apparatus for feeding loose fibres to an opening machine. A conveyor belt 13 is mounted on rollers 15 and 19. Roller 15 is mounted on a lever 17 and a handle 18 may be provided to pivot the lever and conveyor belt. If pivoted upward, as indicated in dot-and-dash lines, the fibres will then by-pass the fibre-beating cylinder 12 and drop from roller 20 directly upon conveyor belt 11. Conveyor belt 11 may also be disposed to allow the material to be fed by hand, in which case conveyor 14 may be stopped. In this

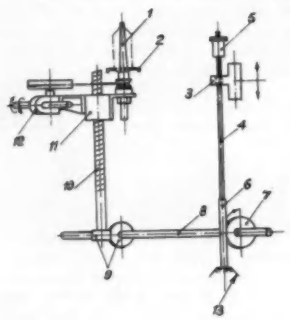


manner it will be possible to use either one of the three possible types of treating the fibres and to switch over very quickly from one type to the other, depending upon the kind and consistency of the material.

809,192 Spinning, etc. Frame Building Motion

"Nazionale Cogne" Societa Per Azioni, 28 *via San Quintino, Turin, Italy.*

A building motion for spinning and twisting machines. The thread guide 2 is secured to a sleeve 3, which is mounted on a rod 4 on which is screwed a regulating knob 5. At the bottom, the rod carries a rack 6 which co-operates with a gear 7 mounted by a free wheel mechanism on a shaft 8, the rotation of which is transmitted, through a train of gears 9 to a worm 10. On the worm is mounted a member 11 which is displaceable axially but is prevented from turning. A support 12 for the tube 1 of the bobbin is fixed to member 11. The thread guide continuously describes reciprocations of a constant amplitude, taking with it sleeve 3. During its upward

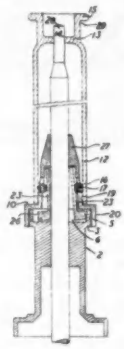


stroke, the sleeve encounters the knob 5 at a certain point, and drives the knob, together with the rod on which it is threaded. The rod by means of its rack imparts rotation to the gear. Depending on the position in which the knob has been set, the sleeve will come into contact with it after a longer or shorter stroke, and this will result in a longer or shorter stroke of the rod and rack and consequently a greater or lesser rotation of the gear. The gear 7 is mounted with a free wheel mechanism, so that during the upward stroke of the rod the shaft is driven, whereas during the downward stroke the gear turns freely on the shaft which remains stationary. The downward stroke of the rod is made under the action of its own weight and is arrested by the rack abutting against a fixed stop 13.

809,196 Centring Tubes on Spindles

Algemene Kunstzijde Unie N.V., 76 *Velperweg, Arnhem, Holland.*

An improved twisting spindle in which an adequate clamping of the tube is effected at lower velocities. A spindle 1 of a twisting spindle has a pulley 2 which has a flange 3, provided with a raised skirt 5, to make a cavity 6. A centring member 19 is screwed on the flange by means of a collar 20 fitting around the skirt. The member 19 has a groove 16, serving as a housing for a rubber ring 17. A tube 12 fits snugly round the member 19 and is supported on a ledge 10. A central bore 21 is provided in the member 19 in order to accommodate the spindle. Two grooves 22 communicate with this bore and a swinging arm 23 is accommodated in each of these. The swinging arms have a pair of knife edges 24



resting in cups 25 formed in the edge of the member 19. At the lower end each arm 23 ends in a supplementary weight 26. In the idle position of the spindle, the arms 23 hang entirely out of contact with the rubber ring. When the spindle is rotating, the arms swing outwards under the influence of centrifugal force, and contribute to the expansion of the rubber ring. The knife edges 24 are kept locked in the cups 25 by means of a nut 27. The free end of the spindle is provided with a centring member 28 fitting a hole 14 in the top 13 of the tube. This top forms a unit with a finger grip 15 provided with a recessed portion 29. Data regarding the yarn wound on the tube may be inserted on the recessed portion.

809,231 Yarn Tension Regulators

Deering Milliken Research Corporation, *P.O. Box* 27, *Pendleton, South Carolina, U.S.A.*

Describes yarn tension regulators with improved dampers which can be inverted without the loss of damping fluid and in which the damping fluid does not become contaminated by dirt, lint and fly. A movable yarn engaging member is fitted with a damper comprising an agitator which extends into a fluid-tight chamber containing liquid, part of the wall of the chamber being formed by a flexible member which permits movement of the agitator with respect to part of the chamber. Movement of the yarn engaging member gives rise to relative movement between the agitator and the liquid and resistance to this movement due to the resilience of the flexible member is negligible.

809,241 Arranging Pirns for Stripping

Deering Milliken Research Corporation, *P.O. Box* 27, *Pendleton, South Carolina, U.S.A.*

Apparatus to disentangle spent automatic loom quills having tails of yarn. The quills are caused to travel in a path past a pair of rotary cutting rolls so that entangled tails will be cut by passage between the pair of rolls. The rolls are very effective in that they themselves by their shape and rotation, guide tails to the bite where the cutting occurs.

809,321 Core Spun Tyre Cords

Dunlop Rubber Co. Ltd., 1 *Albany Street, London, N.W.*1.

A cord comprises doubled yarns each consisting of a core of one or more continuous filaments around which is spun a layer of staple fibres. The method of making the cord comprises passing staple fibres in roving form through a series of drafting rollers, passing one or more continuous filaments in at the front roller, twisting the filaments and fibres together to provide a single-cored yarn, and doubling a number of such yarns together.

809,322 Filament and Staple Core Spun Tyre Cord

Dunlop Rubber Co. Ltd., 1 *Albany Street, London, N.W.*1.

Describes composite yarns suitable for the manufacture of cords for the reinforcement of pneumatic tyre covers or for belting, which will adhere satisfactorily to rubber and which will have a satisfactory tenacity and extensibility. The composite product comprises a natural or synthetic rubber composition having embedded therein yarns comprising a core of one or more continuous filaments having a layer of staple fibres spun on them. The filaments and the staple fibres in a yarn may be of similar or dissimilar materials. For example, the yarn may contain a rayon, nylon, or "Terylene" filament with a layer of cotton staple. In the process of core-spinning or Belgian doubling the yarn is spun on a conventional spinning frame. The staple fibre is drafted in the usual manner and the continuous filament yarn is fed in at the front roller and twisted with the staple. By correctly balancing the twists, a layer of staple fibre is formed round the centre core of the continuous filament.

809,479 Heat Setting and Twisting of Synthetic Yarns

Moulinage et Retorderie de Chavanoz, 5 *and* 7 *Avenue Percier, Paris* 8e, *France.*

A method of producing a twist yarn in which the yarn is passed first through a setting zone and then through a twisting zone, the yarn being false twisted in the twisting zone and the twist feeding backward in the yarn into the setting zone where the yarn is heated to set the false twist, the twist being removed after the yarn passes the twisting zone. The yarn is heated in the setting zone by passing the yarn through a metal tube so that the yarn contacts the inner wall of the tube, the tube constituting an electrical resistance which is heated by electrical current and the tube has an internal diameter lying within the range 3 - 5 mm. The metal tube is preferably curved and the yarn may be initially passed through the tube by being sucked through.

809,525 Screen Printing

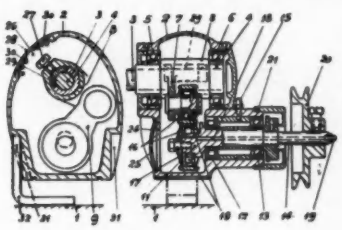
Gebr. Stork and Co.'s Apparatenfabriek N.V., *Boorstraat* 1, *Amsterdam.*

A machine for screen printing a stepwise movable lengtn of cloth comprises at least one squeegee horizontally reciprocable at a non-uniform speed over a liftable screen support, the squeegee being lifted during the lifting of the screen off the cloth. The squeegee is driven continuously to perform an even number of inoperative strokes in its lifted position and subsequently makes a smaller number of operative strokes, the vertical movement of the squeegee being controlled by a rotatable element provided on the shaft from which the horizontal movement of the squeegee is derived. Between the shaft and the mechanism for horizontally driving the squeegee is a transmission mechanism for alternating the short inoperative squeegee strokes with the longer operative squeegee strokes in a predetermined ratio.

809,541 Doffer Comb Driving Unit

ROLLENLAGER-SPINDELFABRIK "SPINTEX" G.M.B.H., 98 *Fornsbacherstrasse, Murrhardt, Wuerttemberg, Germany.*

Describes an improved drive unit for doffing comb shafts in carding machines. The drive unit comprises mounting plates 1 on which is mounted a one-piece housing 2. In the nousing the comb shaft 3 is supported by a bushing 4 and antifriction bearings 5 and 6. Connected to the arm 7 of the oscillatory lever bushing 8 is tne crank arm 9 wnich by antifriction bearings 10 is connected with the eccentric member 11 of the driving shaft 14 supported in antifriction bearings 12 and 13. Rotary motion of shaft 14 is converted into an oscillatory motion of the shaft 3. Resilient sheet-metal covers 16 are parts of the walls confining the chamber 17, and the chamber

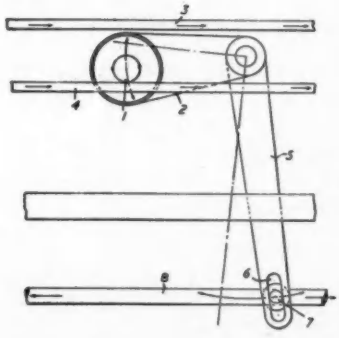


communicates through a duct 18 in the shaft 14. A grease nipple 19 is located near the driving pulley 20 so that the grease in the chamber, which should always be filled, can readily be replenished. A cap 21 prevents dust from entering the housing 2, whose one opening 24 is closed by a resilient sheet-metal cover 25 and whose other opening 26 is closed by a cover 28 situated oppositely to the screw 27. The screw bears upon a member 29 and thus forms a clamp to clamp the member upon the comb shaft 3. The member 29 is so dimensioned that it cannot drop into the bore of busning 4 when the comb shaft is removed, and is provided with extending wedge surfaces. Springs 30 on cover 28 serve for holding it in place on the housing 2. Recesses 31 for receiving the legs of mounting supports 32 are provided on the housing.

809,606 False Twister

ERNEST SCRAGG AND SONS LTD., *Sunderland Street Works, Macclesfield.*

Describes a false twisting mechanism for use in crimping machines. The mechanism comprises a twist tube 1 mounted in a bearing at the end of one arm 2 of a bell crank lever, and the tube is between a pair of endless driving belts, 3, 4. The other arm 5 of the bell crank lever is slotted at 6 accommodating a pin 7 projecting from a traverse rod 8 which is displaceable to bring the tube into contact with one of the driving belts. The traverse rod is associated with a cam or a solenoid mechanism (not shown) by means of which it is reciprocated. In use, a synthetic yarn which may already have a low twist is passed through the tube and with the driving belts moving. The tube is displaced by reciprocation of the traverse rod, so that it is rotated firstly in one direction and then in the other. The cam mechanism can be adjusted so that the contact with the belts takes place for equal lengths of time so that the mean remanent torque in the yarn is zero.



809,821 Polymerising Resins on Moving Fabric

SPOONER DRYER AND ENGINEERING CO. LTD., *Railway Road, Ilkley.*

A method of polymerising resins previously applied to fabric or paper comprises moving the material along a given path and first heating the material to or near to an elevated temperature required for polymerising by directing at a substantial angle for impingement a number of high velocity streams of a heated gas. The material is held at or above this temperature for an extended period of time by surrounding the material with an atmosphere of slowly moving heated gas.

809,822 Improved Water-Repellency Treatment

BRADFORD DYERS' ASSOCIATION LTD., 39 *Well Street, Bradford.*

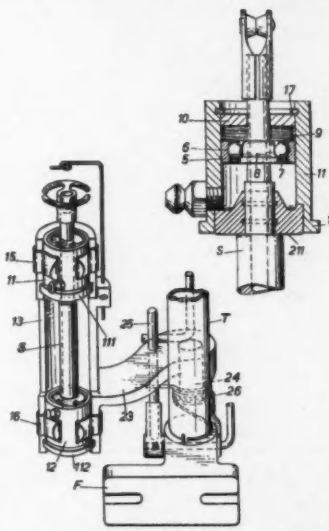
Improved water-repellency is produced by treatment with silicon compounds when the treatments are carried out in conjunction with certain titanium compounds namely alkanolamine esters of titanic acid, particularly triethanolamine, diethanolamine and monoethanolamine esters. In one example an emulsion of silicone is prepared by agitating a solution of 3·1 parts of cetyl dimethyl benzyl ammonium chloride and 0·1 parts of acetic acid in 11·4 parts of water and adding 61·9 parts of a solution of silicone in white spirit containing 65 parts of silicone per 100 parts of solution. After passing through a colloid mill a further 23·5 parts of water are mixed in to give 100 parts of an emulsion containing 40 parts of silicone. A cellulose acetate poult fabric is impregnated with the emulsion diluted with water to give a silicone solids content of 2·5 parts for every 97·5 parts of the aqueous phase. 100 parts of fabric pick up 80 parts of liquid to give 2 parts of silicone solids for every 100 parts of fabric. The fabric is dried and heated at 150°C. for 4 minutes. A similar specimen of fabric is impregnated with a solution of 2.5 parts of triethanolamine titanate in water and dried to give 2 parts of triethanolamine titanate for every 100 parts of fabric. The fabric is heated at 150°C. for 4 minutes. A third specimen is impregnated with emulsion prepared as before but containing 2·34 parts of silicone solids and 0·16 parts of triethanolamine titanate (dissolved in the water of dilution) for every 97·5 parts of the aqueous phase. This gives on drying respectively 1·875 and 0·125 parts of the silicone and the titanium ester for every 100 parts of fabric. The fabric is heated at 150°C. for 4 minutes, and the three specimens then tested by the Bundesmann water repellency test. The results are as follows :

	Absorption (%)	*Penetration* (*c.c.*)
Not proofed	108	120·0
Incorporating 2% silicone	77·3	45·0
Incorporating 2% triethanolamine titanate..	129	102·5
Incorporating 1·875% silicone & 0·125% triethanolamine titanate	35·8	1·5

809,946 Mounting Spindles

SYDNEY AND E. SCRAGG LTD., *Oxford Road, Macclesfield.*

Describes the mounting of spindles in winding and twisting machines, especially for producing crimped yarn. A pivotted false-twist device comprises a hollow spindle S mounted in upper and lower ball bearings. These bearings are in housings 11 and 12 which fit on to semi-circular seats spaced apart on a cradle 13. The housings have flanges 111 and 112 fitting into grooves in the seatings to provide vertical location. The housing 11 is closed by a base 211 having a bore through which passes a reduced portion of the spindle. Above this, there is a slightly tapered portion of the



spindle. A ball-bearing comprising an outer race 5, a set of balls 6, a spacing member 7 and an inner race 8 is in the housing. The outer race is urged down by a spring 9 beneath a cover plate 10 retained in position by a circlip 17. The housings are each held in position by a spring clip 15 or 16 having two spring arms. The cradle is provided with an arm 23 having a pivot 24 which is mounted in a bore in the base, and a peg (25) extends through the arm, so as to project above and below. The peg acts as an abutment for a coiled spring 26 which surrounds a portion of the arm which is co-axial with the pivot pin 24. The other end of the spring bears against a tube T, fixed in a base having a flange (F) adapted to be bolted to a spindle rail. A driving belt runs along the length of the frame, and the spring 26 causes cradle 13 to press the spindle into driving contact with the belt against the reaction of the jockey pulley.

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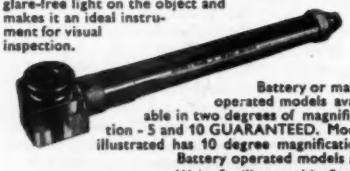

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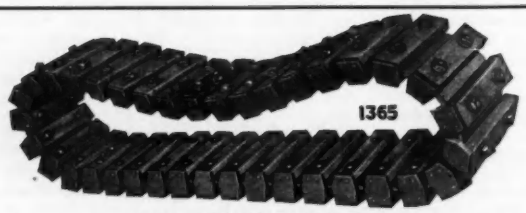

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